CRWMS/M&O

Specification Cover Sheet

Complete only applicable items.

(1.) QA: L
Page: 1 Of: 29

2. TITLE ESF GROUND SUPPORT - STRUCTURAL STEEL AND ACCESSORIES	8/5/96 EFFECTIVE DATE
3. DOCUMENT IDENTIFIER (Including Rev. No.) BABEE0000-01717-6300-02341 REV 00	RECEIVED
4. QA CONTROLS Q Specification subject to QA controls	FIELD CONTROLLED COPY No. 100290 THIS IS A RED STAMP AUG 0_ 1996 DOCUMENT AND RECORDS CENTER

5. Rev. No./ (Date)	6. Description of Revision
00 06/28/96	**NOTE:** The document Identifier (DI) for this specification has been changed to adopt a new CI (BABEE0000). The original DI for this specification was: BABEAB000-01717-6300-02341. Revisions 00, 01, 02, and 03 were developed and approved under the original DI and are superseded by this specification. The new DI is: BABEE0000-01717-6300-02341 which is adopted in this specification. The new DI will start with Rev. 00. Existing procurement contracts for steel sets shall be executed in accordance with paragraph 1.01B of this specification. The summary description of changes for this revision of the specification is presented below. BABEE0000-01717-6300-02341 REV 00 Title of specification changed. This is a major revision to the previous specification and includes extensive changes to text, major reorganization to enhance clarity, and changes to incorporates material dedication requirements for purchase from a commercial grade source. Incorporates the following changes (all with modifications) against the original DI: 1. BCPs: BCP-02-95-0009 (Rev. 1), BCP-02-95-0014 (Rev. 1), BCP-02-95-0020, BCP-02-95-0025, BCP-02-95-0031 (Rev. 1), and BCP-02-95-0051. 2. ECRs: ECR E95-0056, ECR E96-0019, ECR E96-0025, ECR E96-0052, ECR E96-0072, and ECR E96-0079. The following change was closed: ECR E96-0062 (superseded by ECR E96-0072). Added Figures in Attachment 1 Added Attachment 2 for Material Dedication requirements.

7. ORIGINATOR Marvin D. Stine	Date 06/28/96
8. CHECKER Matthew J. Gomez	Date 06/28/96
9. LDE Malcolm E. Taylor	Date 6-28-96
10. VERIFIER LAWRENCE R. MORRISON	Date 6/28/96
11. QUALITY ASSURANCE D J Gilstrap	Date 6/28/96
12. DEPARTMENT MANAGER W R KENNEDY	Date 7.02.96

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PDR WASTE
WM-11 PDR

- Part 1

0061 (Rev. 12/16/95)

NOTICE OF OPEN CHANGE DOCUMENTS			
THIS DOCUMENT IS IMPACTED BY THE LISTED CHANGE DOCUMENT AND CANNOT BE USED WITHOUT THEM			
CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS

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BABEE 0000-01717-6300-02341 REV. 0

2.TITLE	
ESF GROUND SUPPORT - STRUCTURAL STEEL AND ACCESSORIES	
3. DOCUMENT IDENTIFIER (Including Rev. No.)	
BABEE0000-01717-6300-02341 REV 00	
4. Rev No./ (Date)	5. Description of Revision
00 06/28/96	Removed TBV-192, which was released 12-30-94. Removed TBV-225, which was released 06-27-96 Added the following TBDs and TBVs (with description): TBD-146: Thermal design loads for ESF to be determined. TBD-154: Credible fire and explosion risk in ESF to be determined. TBD-158: Design of Alcove opening framing to be determined. TBV-069: Rock mass strength estimates based on (assumed) unqualified data. TBV-073: Depths of locations used in ESF ground support analysis based on (assumed) existing geologic data. The following TBDs and TBVs have been carried forward from the previous specification: TBD-147: Thermall induced stresses in the lining to be determined. TBV-193: Seismic design values for permanent items to be verified. Issued for Construction

SECTION 02341

ESF GROUND SUPPORT - STRUCTURAL STEEL AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work covered by this Specification Section includes the furnishing of all labor, materials, tools, fabrication, testing and inspection, delivery, and erection for the steel set ground support systems in the Exploratory Studies Facility (ESF) Topopah Springs (TS) Loop from approximate Station 0+60 m at the end of the Starter Tunnel near the North Portal to breakthrough at the South Portal as specified herein.

B. Any release order directing the purchase, fabrication, and subsequent receipt inspection of structural steel and accessories procured under Contract No. 1848-CU-001, regardless of the release order issuance date, shall be performed in accordance with the purchasing documents associated with that contract. However, the installation of those items shall be in accordance with the applicable requirements of this specification section, including any requirements to be applied retroactively where specified in individual paragraphs.

1.02 RELATED SECTIONS

A. Division 1, General Requirements.

B. Section 02165, Rockbolts, Accessories and Associated Ground Support Material.

1.03 REFERENCES

A. American Institute of Steel Construction, Inc. (AISC):

AISC M016-89	Manual of Steel Construction, Allowable Stress Design, Ninth Edition

B. American Society of Mechanical Engineers (ASME):

ASME B18.5-90	Round Head Bolts (Inch Series)

C. American Society for Testing and Materials (ASTM):

1. ASTM A6/A6M-94a	Standard Specification for General Requirements for Rolled Steel Bars, Plates, Shapes, and Sheet Piling
2. ASTM A36/A36M-94	Standard Specification for Carbon Structural Steel

3. ASTM A53-94 — Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless

4. ASTM A307-94 — Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

5. ASTM A370-94 — Standard Test Methods and Definitions for Mechanical Testing of Steel Products

6. ASTM A563-94 — Standard Specification for Carbon and Alloy Steel Nuts

7. ASTM F436-93 — Standard Specification for Hardened Steel Washers

8. ASTM F606-90 — Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets

D. American Welding Society, Inc. (AWS):

AWS D1.1-94 — Structural Welding Code-Steel, Thirteenth Edition

E. Code of Federal Regulations (CFR):

10CFR21-95 — Title 10, Part 21; Reporting of Defects and Noncompliance

F. Yucca Mountain Site Characterization Project Procedure:

YAP-2.8Q — Tracers, Fluids, and Materials Data Reporting and Management

G. Electric Power Research Institute (EPRI):

EPRI NP-7218 — Guideline for the Utilization of Sampling Plans for Commercial-Grade Item Acceptance (NCIG-19), June 1992

1.04 QUALITY ASSURANCE

A. Quality Assurance (QA) shall be conducted in accordance with Specification Section 01400.

B. This Specification Section covers items and activities which are subject to QA Controls ("Q"). QA Controls are denoted with underlining and are preceded by "QA Control:".

C. Acceptance of Product:

1. QA Control: All items identified as "Q" in this specification shall be procured from a Commercial Grade source or from a Qualified source.

2. QA Control: "Q" items purchased from a Commercial Grade source shall be subject to material dedication requirements as specified in Attachment 2.

3. QA Control: C of Cs and CMTRs (or MTRs) shall be provided for "Q" steel shapes, plate, pipe, and weld filler material (typical MTRs acceptable) unless otherwise noted herein. As a minimum, C of Cs shall be provided for "Q" bolts, studs, tie rods, and nuts. On CMTRs or MTRs identifying test results for multiple heat lots of "Q" items purchased from a Commercial Grade source, the corresponding C of Cs shall identify the heat lots used in filling the associated purchase order.

4. QA Control: Standard receipt inspection of "Q" items shall include:

   a. Dimensional/visual inspection for conformance with purchasing documents which impose the requirements of this Specification Section.

   b. Verification that certification documents (C of Cs, CMTRs and/or MTRs) are received, acceptable, and in accordance with purchasing documents which impose the requirements of this Specification Section.

   c. Inspection to ensure that damage was not sustained during shipping.

5. Receipt Inspection for items not identified as "Q":

   a. Dimensional/visual inspection for conformance with purchasing documents which impose the requirements of this Specification Section.

   b. Documentation, as applicable, that the item was received and is in conformance with the purchasing documents which impose the requirements of this Specification Section.

   c. Inspection to ensure that damage was not sustained during shipping.

D. Packaging, Handling, and Storage:

1. Packaging and handling of materials shall be in accordance with the following:

   a. QA Control: Specification Section 01600, Paragraph 3.01, except as modified below.

   b. Structural steel W and C shapes greater than 24 inches in length or width need not be boxed or crated, but shall be blocked and anchored to prevent damage to the product during shipping.

c. Pieces of structural steel and plates less than 24 inches in length and width and miscellaneous small items (bolts, studs, nuts, washers, clips, etc.) shall be boxed, crated, or banded for ease of shipping and to prevent damage to the products during handling.

2. QA Control: Storage of "Q" materials shall be in accordance with the following:

a. Specification Section 01600, Paragraphs 3.02A, 3.02B.4, 3.02C.1, 3.02D, and 3.02F.5 with the additional requirements identified below.

b. Materials received shall be controlled to preclude inadvertent use of items prior to receipt inspection.

c. Materials purchased from a Commercial Grade source shall be uniquely identified or segregated to distinguish them from like items purchased from a Qualified source to preclude inadvertent use prior to completion of material dedication.

d. Materials that are purchased and accepted for use in "Q" applications shall be segregated from like items purchased for use in applications not subject to QA Controls.

e. Materials that are purchased and accepted for use in "Q" applications shall be identified to distinguish them from like items purchased for use in applications not subject to QA Controls.

E. Traceability of heat numbers indicated on CMTRs and/or MTRs to individual items for a purchased lot of materials (as shown on the corresponding C of Cs) is not required.

1.05 SYSTEM DESCRIPTION

A. The ESF TS Loop ground support structural steel includes steel sets and related accessories.

B. The steel set systems include permanent components and provide immediate ground support for personnel safety after installation. The permanent function steel set systems provide long-term ground support in the ESF TS Loop for a maintainable life of 150 years.

1.06 DEFINITIONS

Following are definitions of selected terms as used in this specification:

A. *Certificates of Compliance* (C of Cs): A written statement, signed by an officer of the fabricator/supplier, certifying that a particular lot of items comply with requirements specified in the procurement documents. For CGIs, the C of C should state that the commercial grade control activities documented during the Commercial Grade Survey were invoked in the fabrication/manufacture of the CGIs addressed by the C of C.

B. *Certified Material Test Report* (CMTR): A written report identifying tests and test results performed on an item representing a particular lot of items. The CMTR results confirm that the lot conforms to the requirements of the codes or standards under which the items were manufactured, consistent with the requirements specified in the procurement documents. CMTRs shall be certified by a responsible individual representing the testing organization.

C. *Mill Test Report* (MTR): A written report which is similar to a CMTR (may or may not be certified) that reports the results of tests performed at the mill by the manufacturer of the basic product. The MTR results confirm that the item conforms to the requirements of the codes or standards under which the items were manufactured and is consistent with the requirements specified in the procurement documents.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL AND OTHER STEEL COMPONENTS

A. QA Control: The following "Q" structural steel ground support components shall be of the materials shown below. Materials of equal or greater strength may be substituted, subject to A/E approval of shop drawings that clearly delineate the substitutions:

1. Steel Set Segments - W Shape: ASTM A36/A36M, 58 ksi minimum tensile strength.

2. Steel Lagging - C Shape: ASTM A36/A36M, 58 ksi minimum tensile strength.

3. "Q" Lagging Clamps (those used to support lagging and rock loads in a direct bearing connection): ASTM A36/A36M, 58 ksi minimum tensile strength.

4. Tie Rods: ASTM A307, 58 ksi minimum tensile strength.

5. Pipe Spacer: ASTM A53, 60 ksi minimum tensile strength.

6. "Q" Bolts and Studs (those used in steel set segment connections & "Q" lagging clamp connections): ASTM A307, 58 ksi minimum tensile strength. Round head (Carriage) bolts shall also conform to ASME B18.5.

7. "Q" Nuts (those used on tie rods, in steel set segment connections, and in "Q" lagging clamp connections): ASTM A563, 175 ksi minimum proof load stress.

8. Weld Filler Metal: AWS D1.1, Section 4, 70 ksi minimum tensile strength.

9. Steel Set Foot Plates: ASTM A36/A36M, 58 ksi minimum tensile strength.

10. "Q" Joint Plates (those used on steel set segments and inserts): ASTM A36/A36M, 58 ksi minimum tensile strength.

11. Insert Segments - W Shape: ASTM A36/A36M, 58 ksi minimum tensile strength.

12. Steel Set Foot Segments -W Shape: ASTM A36/A36M, 58 ksi minimum tensile strength.

13. "Q" Shim Plates **(those used in steel set segment connections)**: ASTM A36/A36M, 58 ksi minimum tensile strength.

B. The following components and items are not subject to QA Controls, and shall be of the following (or higher strength) materials:

1. Steel Wedges: ASTM A36/A36M, 58 ksi minimum tensile strength.

2. Steel Blocking and Miscellaneous Structural Steel: ASTM A36/A36M, 58 ksi minimum tensile strength.

3. Wood Blocking or Wedges: untreated wood, type and grade suitable for the application as determined by the Constructor.

4. Bolts and Studs **(those not used in "Q" lagging clamp connections)**: ASTM A307, 58 ksi minimum tensile strength. Round head (Carriage) bolts shall also conform to ASME B18.5.

5. Nuts **(those not used in "Q" lagging clamp connections)**: ASTM A563, 175 ksi minimum proof load.

6. Washers: ASTM F436, Type 1, 38 to 45 HRC hardness.

7. Lagging Clamps **(those not used to support rock loads)**: ASTM A36/A36M, 58 ksi minimum tensile strength.

8. Shim plates **(those used on tie rod pipe spacers)**: ASTM A36/A36M, 58 ksi minimum tensile strength.

C. All permanent bolts, studs, tie rods, nuts, and washers shall be new.

2.02 FABRICATION

A. QA Control: The configuration of structural steel sets, lagging, tie rods, joint plates, foot plates, pipe spacers, and steel accessories shall be in conformance with the details shown on the Figures 1 through 6 (or as modified by A/E approved shop drawings). All Figures can be found in Attachment 1.

B. Tolerances: The tolerances shown below represent minimum workmanship requirements for fabrication. Tolerances apply to dimensions shown on A/E approved shop drawings:

1. Shop Bending Tolerances for Steel Set W-Shapes:

    a. Steel set W-shapes between end joints may depart from a true template within plus or minus 3/8 inch provided no point departs more than 3/16 inch in any 3-foot gage length. The steel set segments shall be of uniform contour.

    b. Flanges shall be true to shape within established mill rolling tolerances except that after bending, the outer flange will be permitted to droop 1/8 inch maximum toward the inner flange. Flange droop will be in addition to any flange deviation allowed within mill rolling tolerances.

    c. The web shall be true within established mill rolling tolerances, and free of cracks and wrinkles. Where radii of bends are 14 or more times the beam depth, buckling of the web for a distance of one-half the beam depth from each end will be permitted where deviation from flat does not exceed plus or minus 1/8 inch.

    d. Depth of W-shape at web after bending can be a maximum of 1/4 inch less than the nominal depth.

    e. Sweep in W-shapes between joint plates at ends shall not exceed 5 inches.

2. Shop Fabrication Tolerances for Steel Sets and Accessories:

    a. The joint and foot plates after welding shall be within plus or minus 1/8 inch of square with respect to the Y-Y axis of the W-shapes. Flatness tolerance for plates shall be plus or minus 1/16 inch prior to welding.

    b. Tie rod holes in web of W-shapes shall lie within the envelope dimensions shown in Figure 2. Tie rod pair hole spacing shall be within plus or minus 3/8 inch of dimension between holes ("S" on Figure 2). Tie rod hole group spacing shall be within plus or minus 3/8 inch on dimension from W-shape centerline, and plus or minus 1 inch on theoretical arc length dimension along length of the beam.

    c. Mill rolling tolerances shall apply to the width of plates with milled edges in accordance with AISC M016, page 1-158. Width or length of sheared plates shall be within plus or minus 1/8 inch.

    d. Groups of holes in joint plates after assembly shall lie within plus or minus 1/8 inch of correct location regardless of the variations that may exist in the W-shapes as a result of allowable tolerances.

C. Welding:

1. QA Control: For "Q" items purchased from a Qualified source, welding shall be performed in accordance with AWS D1.1. Acceptance of welds shall be in accordance with AWS D1.1 Section 9.25.1 (1/32 inch deep undercut criterion applies to all welds).

2. For "Q" items purchased from a Commercial Grade source, welding shall be performed in accordance with AWS D1.1. Acceptance of welds shall be in accordance with Attachment 2.

D. Fabricate steel components and steel construction items (except blocking) which are not subject to QA Controls in accordance with AISC M016 standard practice. Steel blocking may be field cut and fabricated as ground conditions dictate using tunnel supervisory controls as normally applied to timber blocking.

2.03 FINISH

After fabrication, clean all structural steel of weld slag, flux deposit, dirt, and other foreign matter. Light surface films from oil and lubricants are acceptable provided they do not run or pool. Pipe spacers shall not be hot-dipped zinc-coated, and all steel set and accessory items shall not be primed or painted.

PART 3 EXECUTION

3.01 FIELD CONNECTIONS

A. Field connections to steel set W-shapes shall be bolted or welded. Connections for utility brackets shall be bolted or clamped.

B. QA Control: Performance and acceptance of field welding on any "Q" items shall be in accordance with the requirements of Paragraph 2.02C.1. In addition, field welding, drilling, and cutting of structural members of the steel sets shall be performed in accordance with procedures and drawings submittted to the A/E for approval prior to execution (HOLD POINT). The Test Coordination Office (TCO) may drill holes less than ½ inch diameter and may use small electronic fusion tack or spot welds for attaching test instrumentation to the steel sets. The method of attachment of test instrumentation shall be approved by the A/E.

C. Field drilled holes in steel set flanges shall be located in accordance with the standard gage for W-shapes, and nominal hole dimensions shall be in accordance with Table J3.1 of AISC M016. Edge distance for holes shall be in accordance with Table J3.5 and J3.6 of AISC M016. For fasteners (or holes) less than ½ inch in diameter, the edge distance criteria in the tables for ½ inch diameter fasteners shall apply.

D. QA Control: Steel sets shall have bolted connections installed to a snug tight condition. Bolt head and nut or washers shall make contact with the joint plates. Snug tightness shall be in accordance with AISC M016, except that gaps between joint plates and shims may exceed 1/16 inch if plates or plates and shims make contact at any point in the connection plane.

3.02 ERECTION

A. All steel sets shall be installed in accordance with the following criteria:

1. The type of steel set (W6 or W8), steel set spacing (2, 4, or 6 ft), and type of ground protection (C8 lagging, wire fabric, or interlocking mesh) shall be selected in accordance with Specification Section 01501 and associated drawings. Once assembled and clear of the tunnel boring machine shield, the steel set shall be expanded against the rock surfaces through jacking or other approved methods using structural inserts and/or shims as needed to fill the spaces created between steel set segments during the expansion process.

2. The steel sets shall be installed nominally perpendicular to the as-bored tunnel grade.

3. QA Control: The steel sets shall be expanded into final position using jacks or other means to develop positive contact of the steel sets, lagging, wire fabric, or interlocking mesh against the tunnel perimeter, and shall be firmly shimmed in the expanded position until a 1/8 inch shim cannot be installed by hand in the remaining gap. Voids in the crown and walls shall be wedged or blocked as necessary to create positive contact between the steel set and rock.

4. QA Control: The jacking/expansion process shall not overstress the steel set W-shapes. The Constructor shall submit a jacking/expansion procedure (including details of jacking brackets or expansion fixtures) for A/E approval prior to expanding the steel sets (HOLD POINT).

   a. For expansion methods that use a bracket attached to the inner flange of the W-shape to transfer the jacking force into the steel set, the expansion/jacking force shall be controlled by the Constructor as follows:

      1) The jacking/expansion force shall be controlled so that the maximum force on either side of the steel set during the jacking/expansion operation does not exceed 27 tons on the W8 or 17 tons on the W6.

      2) The line of action of the jacking/expansion force shall be in line with the Y-Y axis of the W-shapes, and shall not exceed 6 inches from the centerline X-X axis of the W8 or 5 inches from the centerline X-X axis of the W6 (X-X and Y-Y axes shall be as shown in AISC M016, Part 1).

5. QA Control: Lagging, welded wire fabric (WWF), or interlocking steel mesh (ISM) shall be installed as needed to control sloughing, spalling, or fallout of rocks in the crown and walls of the tunnel. See Specification Section 02165 for WWF and ISM material requirements.

6. QA Control: Tie rods and pipe spacers (and shims as needed) shall be provided and located as shown in Figure 2. The tie rod nuts shall be tightened as needed to bring the pipe spacers and/or shims into firm contact with the web of the steel set W-shape.

7. The use of temporary wood blocking or wedges shall be minimized. Wood blocking or wedges shall be removed to the extent practical when no longer needed. QA Control: Any unrecovered wood blocking or wedges shall be recorded in accordance with YAP-2.8Q.

B. Erection tolerances for the steel sets are as follows:

1. QA Control: Steel set spacing shall not exceed the nominal required spacing for the selected support category (as determined in accordance with Specification Section 01501) by more than 2 inches.

2. QA Control: Steel sets shall be placed so that the edge of the foot plate is no closer than 4 inches from the edge of the precast concrete invert segment joint (see Figure 6).

3. The steel set foot segment shall be installed on the invert segment so that the base plate of the foot segment is positioned on the curb of the invert segment as shown in Figure 6, to the extent practical. Minor offset of the base plate toward the tunnel centerline and/or lack of full contact of the base plate on the invert segment curb caused by irregularities in the tunnel wall or resulting from the expansion operation are acceptable as long as the foot segment is properly positioned prior to expansion. Localized spalling of the concrete invert segment curb, obvious distortion of the steel set base plate, or offset of the base plate exceeding 1 inch at any location (as measured from the inside face of the invert segment curb to the outside face of the adjacent W-shape flange) shall be reported as nonconforming and dispositioned in accordance with applicable YMP procedures.

C. QA Control: The Constructor shall record the size (W8 or W6) and the location (station) of each steel set along the tunnel, the type of lagging used (channel lagging, WWF, or ISM), the extent of lagging coverage (full or partial), and the source of W-shape materials used (CGI or Qualified source) for each steel set.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with Specification Section 01300 and the attached Submittal and Notification Requirements sheet.

B. Any revision to submittals prepared in accordance with this Specification Section shall be forwarded to the A/E for approval in accordance with the submittal and notification requirements for the original submittal.

C. QA Control: The Constructor shall submit shop drawings to the A/E for approval prior to fabrication (HOLD POINT).

1. Show the profiles and sizes of all structural members including all hole sizes, spacings, and locations. Show all connections, attachments, anchorages, sizes, and types of fasteners.

2. Show all welded connections using standard AWS welding symbols to indicate net weld lengths, types, and sizes. Show type of weld filler metal to be used.

3. Show all bolted connections, including the type, number, size, and location of all bolts.

4. Show attachment details for jacking/expansion fixtures.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Constructor shall notify the A/E in writing for approval.

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 02341

TITLE: ESF Ground Support - Structural Steel and Accessories

Requirements	Paragraph	STATUS: INFORMATION/RECORD	STATUS: REVIEW/APPROVAL					TIMING: PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL APPROVAL	PRIOR TO EXECUTION		NOTIFICATION: WITNESS (DAYS) *	HOLD (DAYS) *		
Field Welding/Drilling/Cutting Procedures/Drawings	3.01B		X														X			5		
Jacking Procedure	3.02A.4		X										X							10		
Shop Drawings	4.01C		X							X										10		
Commercial Grade Survey Procedure	Attach 2 B.1		X														X			10		
Additional Quality Controls	Attach 2 B.2		X							X										5		
Sampling Plan	Attach 2 C.2.c		X														X			5		

COMMENTS:

* "X" in the Notification columns denotes a HOLD or Witness Point is required by the Specification subsection, but prior notification of the A/E is not necessary.

ATTACHMENT 1

FIGURES

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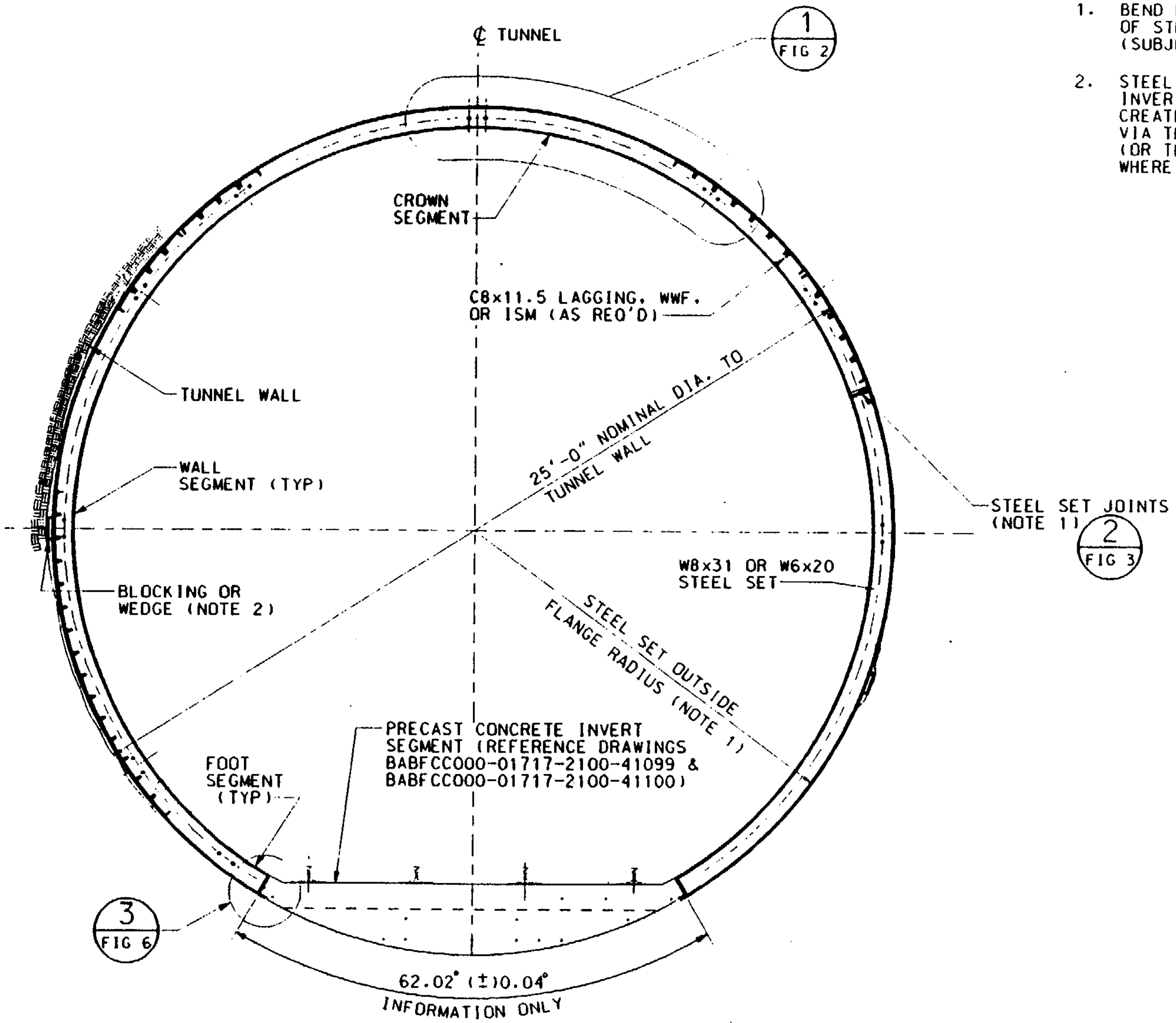
NOTES:

1. BEND RADIUS OF STEEL SETS AND QUANTITY & LOCATION OF STEEL SET JOINTS SHALL BE DETERMINED BY CONSTRUCTOR (SUBJECT TO A/E APPROVAL OF SHOP DRAWINGS).

2. STEEL SET SHALL BE CONFIGURED TO BE FOUNDED ON THE INVERT SEGMENT CURB AND TO FACILITATE EXPANSION TO CREATE POSITIVE CONTACT WITH THE TUNNEL PERIMETER VIA THE W-SHAPE, LAGGING, WWF, OR ISM (OR THROUGH THE USE OF WEDGES OR BLOCKING WHERE VOIDS OCCUR).



TYPICAL STEEL SET

SCALE: NONE

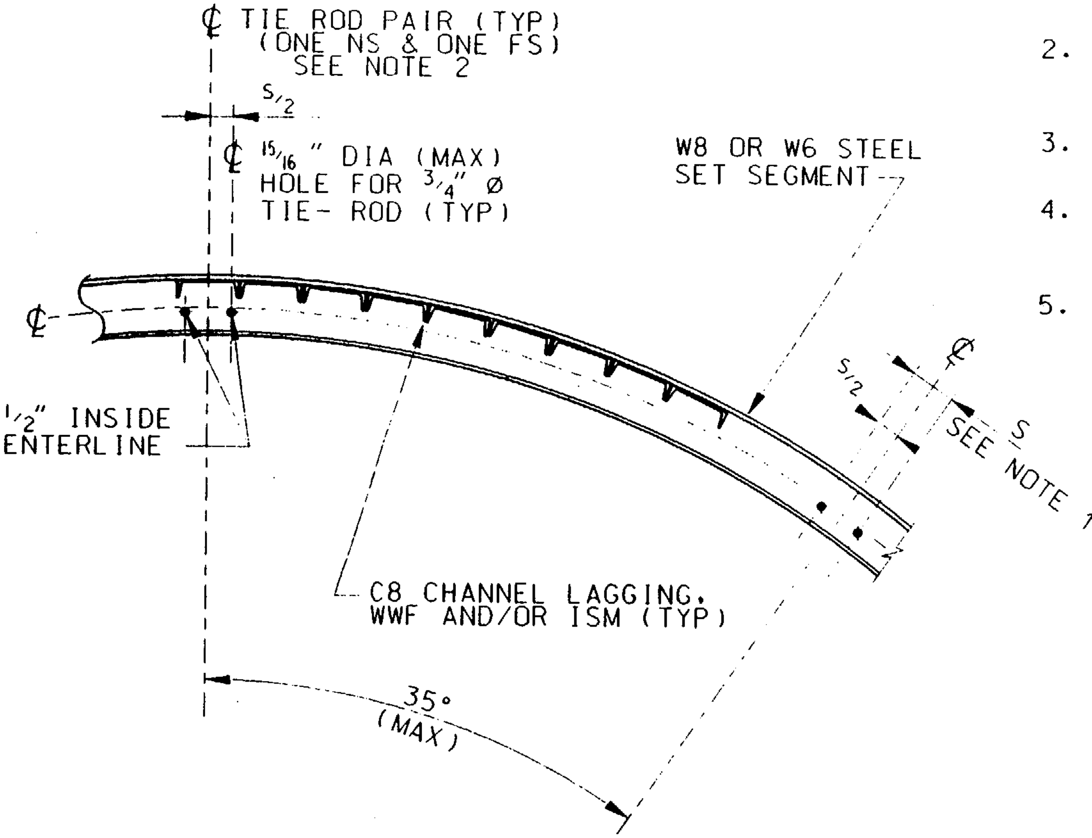
ATTACHMENT 1

TYPICAL STEEL SET GENERAL ARRANGEMENT FIGURE 1

02341-16

NOTES:

1. TIE ROD SEPARATION "S" SHALL BE AS REQUIRED TO FACILITATE INSTALLATION (6" NOMINAL).
2. PROVIDE 1½" DIA. SCH 40 (MIN) PIPE SPACER AT EACH TIE ROD.
3. TIE RODS SHALL BE FITTED WITH NUTS AND WASHERS.
4. STEEL SHIMS SHALL BE USED WITH PIPE SPACERS AS NEEDED TO ADJUST SET SPACING.
5. TIE ROD PAIR TO BE LOCATED NO MORE THAN 7° FROM FOOT SEGMENT BASE PLATES.



DETAIL

SCALE: NONE

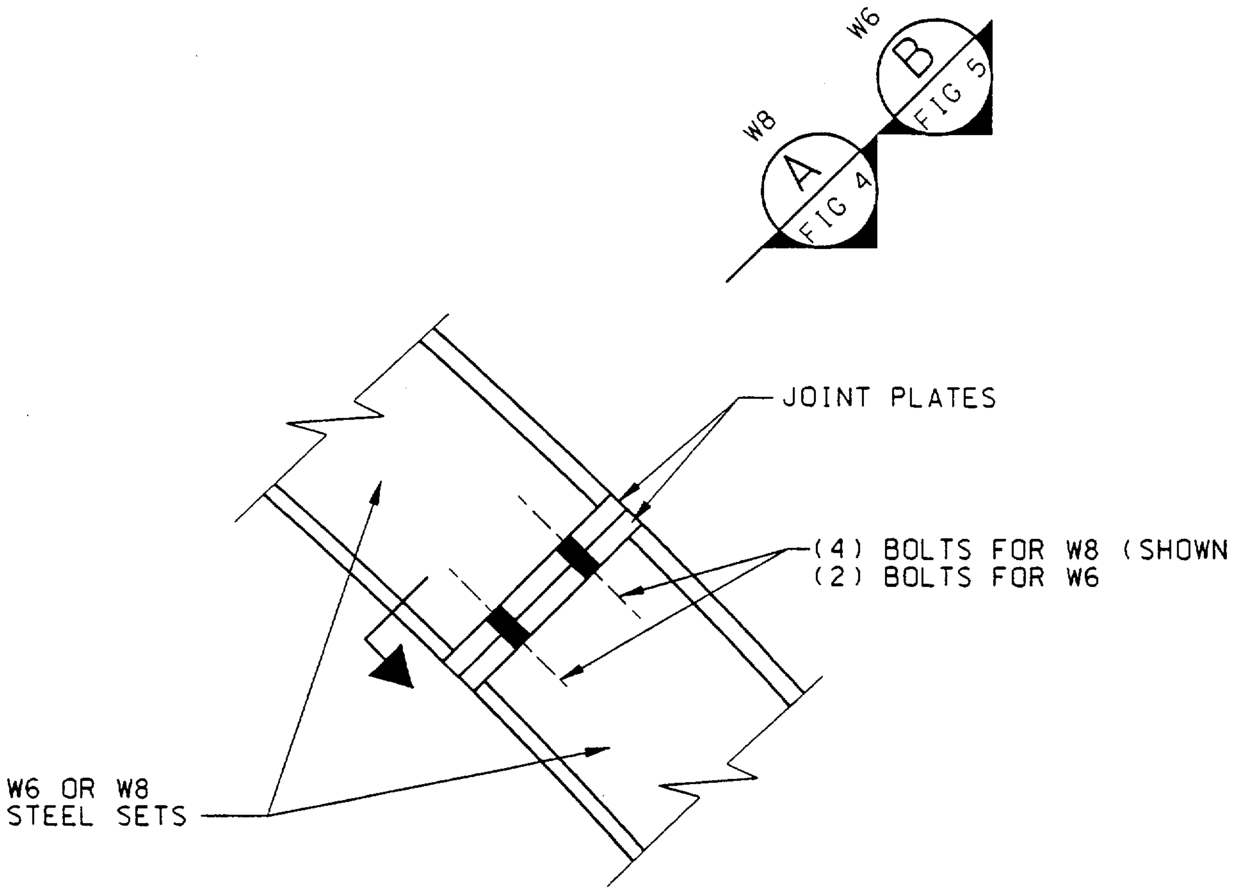
1

FIG 1

TYPICAL STEEL SET

LAGGING & TIE ROD/PIPE SPACER

FIGURE 2



DETAIL 2 / FIG 1

SCALE: NONE

TYPICAL STEEL SET
JOINT DETAIL
FIGURE 3

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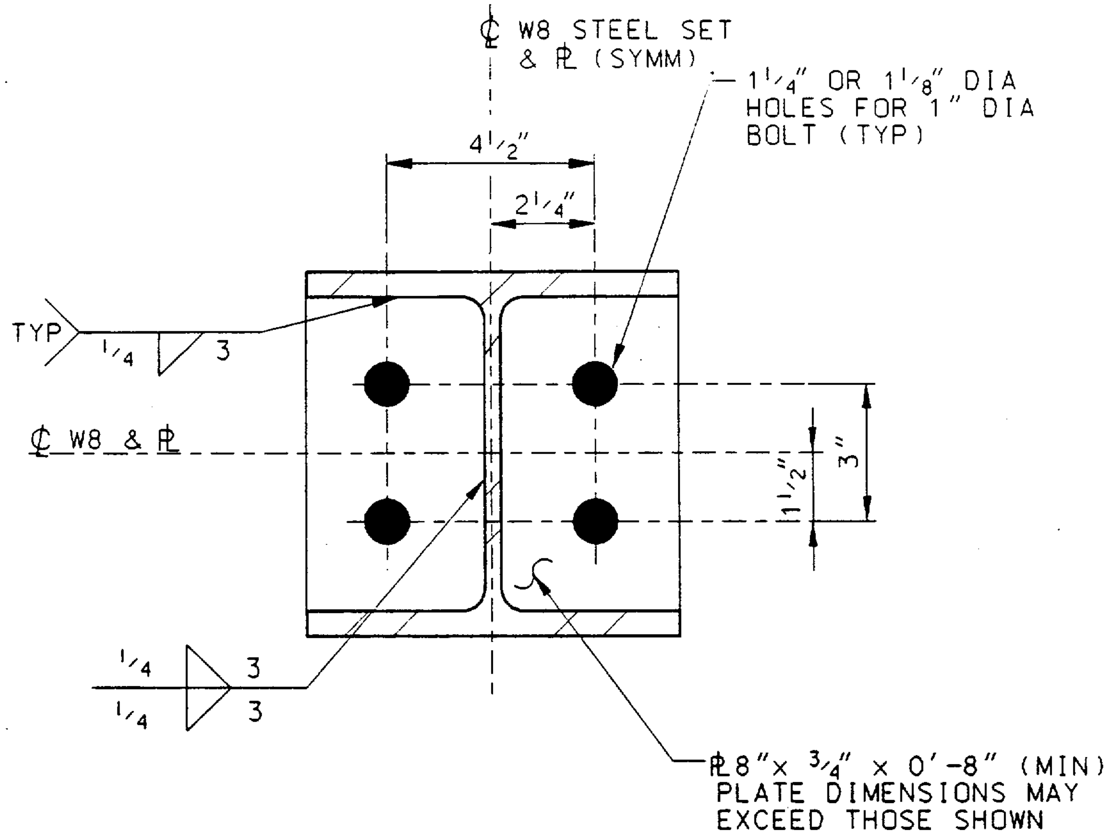
trujillo



SECTION A

SCALE: NONE FIGS 3 & 6

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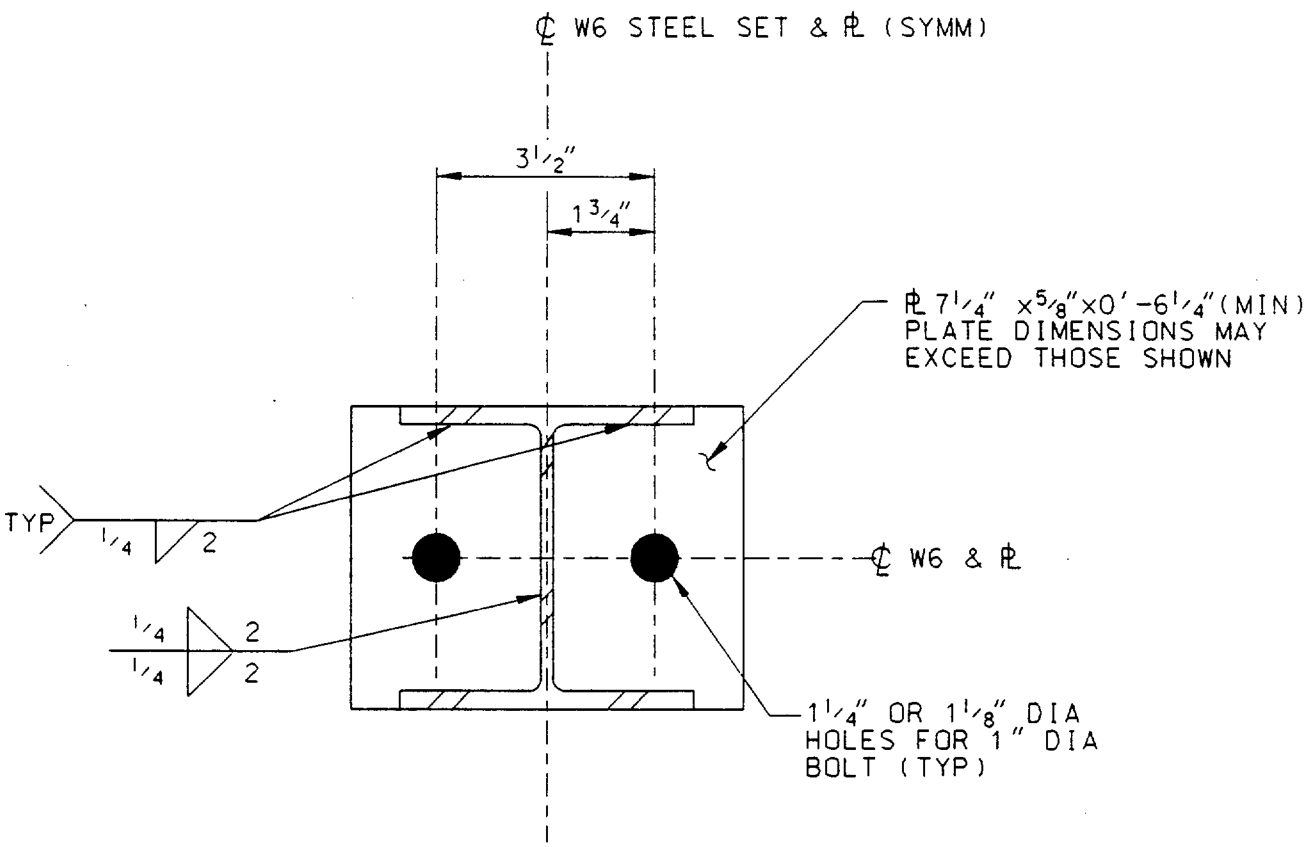
trujillo

TYPICAL STEEL SET
JOINT PLATE SECTION (W8)
FIGURE 4



SECTION B

SCALE: NONE

FIGS 3 & 6

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TYPICAL STEEL SET
JOINT PLATE SECTION (W6)
FIGURE 5

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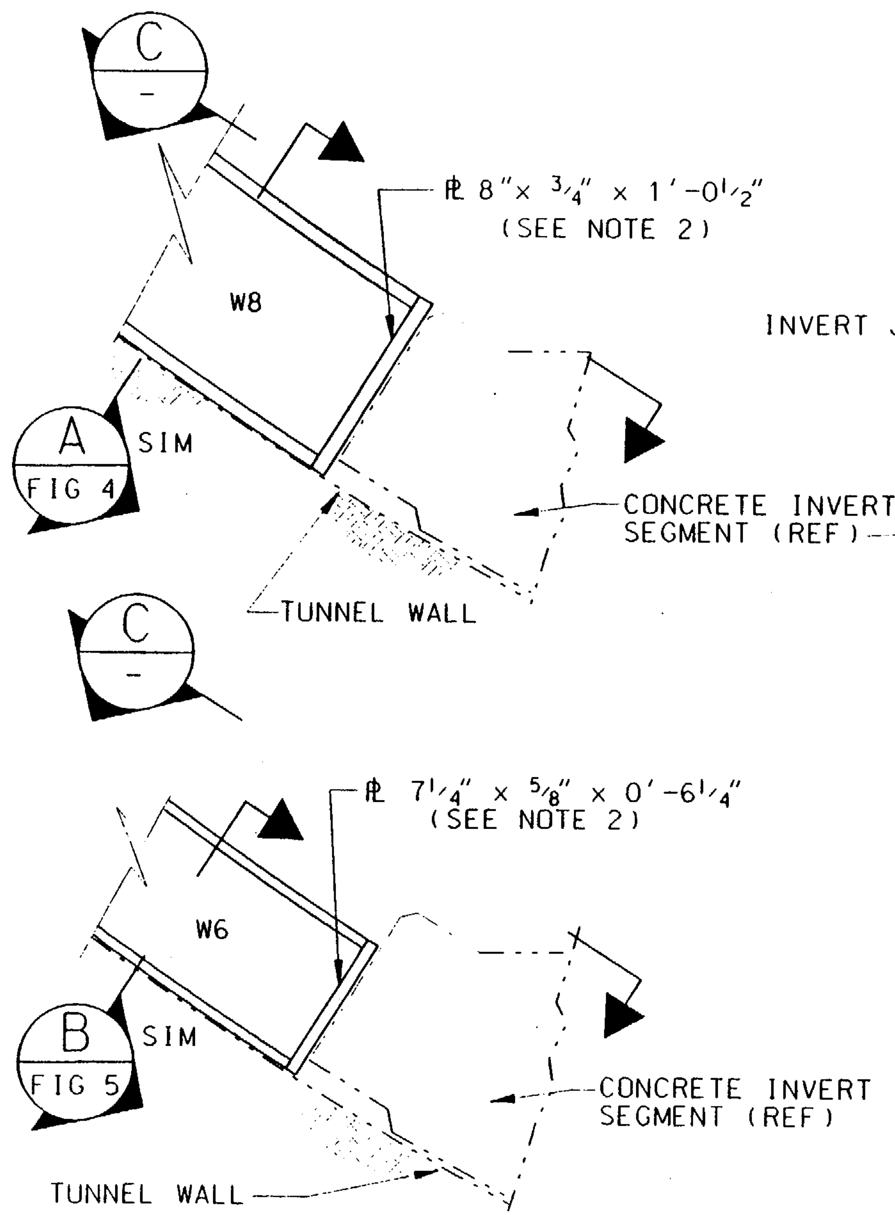
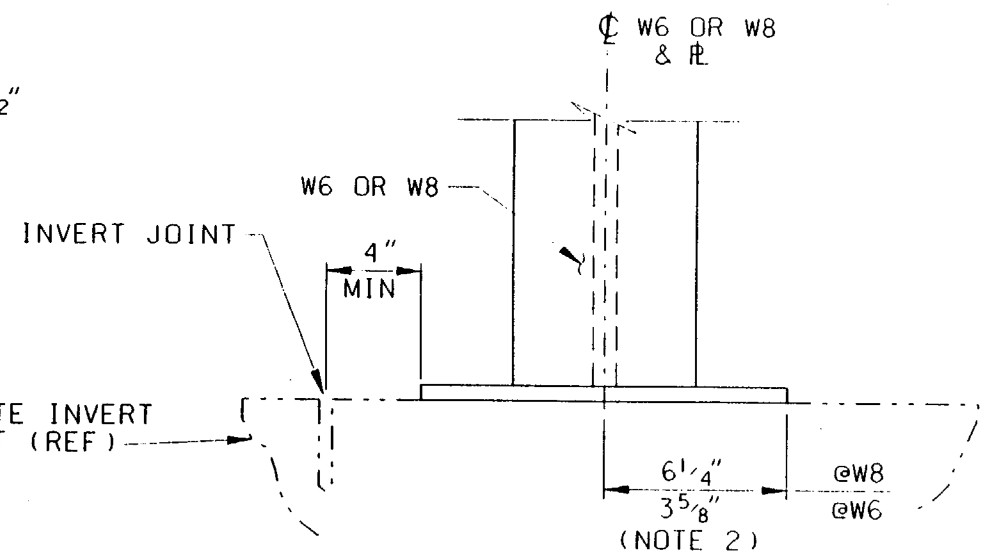


FOOT PLATE DETAIL 3 FIG 1

SCALE: NONE



SECTION C –

SCALE: NONE

NOTES:

1. FOR PLATE WELDING SEE FIG 4 & FIG 5
2. FOOT PLATE SIZES SHOWN ARE MINIMUM

TYPICAL STEEL SET
FOOT PLATE DET & SECT
FIGURE 6

ATTACHMENT 1

02341-21

ATTACHMENT 2

MATERIAL DEDICATION REQUIREMENTS FOR STEEL SETS AND ACCESSORIES PURCHASED FROM A COMMERCIAL GRADE SOURCE

A. GENERAL:

1. Steel set and accessory "Q" items purchased from a Commercial Grade source shall undergo a material dedication process that shall include a Commercial Grade Survey (CGS) and Receipt and Dedication Inspections and Tests (unless otherwise noted), and may include Supplemental Testing as identified in this attachment in order to provide reasonable assurance that the critical characteristics of these items are controlled. The critical characteristics of the Commercial Grade Items (CGIs) addressed in this attachment are shown in Table A2.3.

2. Material dedication of the steel set assembly shall not occur until after completion of the acceptance activities specified herein. In this context, the term "dedication" represents the point in time after which a CGI is accepted for a safety related application and deficiency reporting becomes the responsibility of the party performing the acceptance. For the purposes of this specification, dedication of the steel set assembly is considered to be complete and the assembly accepted for use in a safety related application upon satisfactory conformance with requirements included in this attachment and with specification paragraphs 1.04C.3, 1.04C.4, 3.02A.3, and 3.02B.1.

3. "Q" items purchased from a Commercial Grade source are subject to the provisions of 10CFR21 for defects and noncompliances that are identified after completion of the dedication process of paragraph A.2, above.

B. COMMERCIAL GRADE SURVEY REQUIREMENTS

1. QA Control: Commercial Grade Surveys shall be performed and documented to demonstrate reasonable assurance that the Fabricator's/ Supplier's system of Commercial Grade quality controls are adequate to control the critical characteristics of the CGIs. The Constructor shall submit a CGS Procedure/Checklist to the A/E for approval prior to conducting the CGS (HOLD POINT).

   a. The CGS shall be extended to subsuppliers as necessary to confirm the acceptability of Certificates of Compliance (C of Cs) and related available supporting documentation unless the CGS demonstrates that the fabricator adequately verifies the critical characteristics of materials obtained from those subsuppliers. A separate CGS of bolt, nut, and tie rod subsuppliers is not required since selected destructive acceptance testing (paragraph C.4.c) will be performed on these CGIs.

b. The CGS shall be conducted prior to award of contracts to supply "Q" commercial grade steel sets and accessories to pre-qualify potential suppliers or to disqualify suppliers with inadequate systems for controlling the critical characteristics of the CGIs. Typical supplier controls surveyed and to be addressed in the Constructor's CGS Procedure/Checklist shall include, as a minimum, the following items:

1) *Commercial Quality Program*: Number of quality assurance/control personnel in relation to total production force; existence and type of quality program documentation; quality program indoctrination and training in regard to handling of CGIs; and management involvement in the quality program.

2) *Procurement Document Control:* Do purchase orders (POs) specify technical requirements; are supporting documents (CMTRs, MTRs) acceptable and traceable to items received; and who reviews and accepts POs for CGIs?

3) *Control of Subsuppliers:* Is there an approved suppliers list (ASL) for CGI subsuppliers; how is a subsupplier added to the list; were subsuppliers evaluated prior to award of contracts; does the system assure only qualified subsuppliers are furnishing CGIs if there is no ASL; are orders for CGIs only issued to qualified subsuppliers (or are they issued solely based on price); and is subsupplier documentation reviewed and acceptable?

4) *Test and Inspection Controls*: Are receipt inspections performed for CGIs to any procedure; are CGI drawings, or other documentation available and used for receipt inspections; what do CGI receipt inspections include; are they documented and maintained; what items have receipt inspections; is there a system to ensure CGIs are inspected against PO requirements; are any critical characteristics tested; are in-process and final inspections conducted to assure product conformance; are testing devices (if used) calibrated using acceptable calibration methods; how are deficiencies dispositioned; and who performs the tests and inspections?

5) *Material Control and Traceability*: Does the supplier's material control system include a method for marking and identifying CGIs; and are CGIs traceable from their source?

6) *Control of Special Processes (Welding)*: Are welders and welding procedures documented and qualified to AWS D1.1 or equivalent standards; are weld filler materials controlled and traceable; and are weld inspections performed and documented in accordance with the applicable code and procurement documents?

7) *Control of Handling and Storage:* Are CGIs properly packaged for shipment; are CGIs properly stored and traced from storage through to shipment; who is responsible for CGI packaging and shipment release; and how are non-conforming items handled?

c. Other than documented welding control procedures, the system of supplier controls need not be formal, documented procedures. The survey shall demonstrate reasonable assurance that the supplier's activities control the critical characteristics of the CGIs furnished. For undocumented supplier controls, the CGS shall document the standard procedures used, and an officer of the supplier shall acknowledge concurrence with the survey findings in writing.

2. Supplemental Material Dedication Requirements: If the Commercial Grade Survey does not demonstrate reasonable assurance in selected supplier's Commercial Grade system of controls, additional steps may be taken by the Constructor to provide assurance in the quality of the items furnished. These steps shall consist of the implementation of additional quality controls on the selected critical characteristics (e.g., performing supplemental mechanical tests in accordance with paragraph C.5, below). QA Control: The additional quality controls, if needed, shall be submitted to the the A/E for approval prior to fabrication (HOLD POINT).

C. MATERIAL DEDICATION SAMPLING, TESTING AND INSPECTIONS

1. General: The following paragraphs define sampling, and lot sample dedication inspection and acceptance testing that shall be performed for dedication of Commercial Grade steel sets and accessories.

2. Sampling Methodology:

a. QA Control: Dedication inspection and testing for verification of the critical characteristics of structural steel materials purchased from a Commercial Grade supplier or manufacturer shall be by lot sampling methodology as specified herein. Items randomly selected for dedication testing/inspections may be those sampled for receipt inspections and may be selected based on ease of access to the sample where bundled, stacked, crated, or similarly constrained.

b. QA Control: The Constructor shall develop a Sampling Plan using the lot sample acceptance methodology in EPRI NP-7218, Section 2 as a guideline (unless otherwise noted herein), and using the minimum initial sampling frequencies as specified in Table A2.1. As a minimum, the Constructor's Sampling Plan shall address the following:

1) Formation of lots for inspections and tests for each item to be sampled.

2) Method of randomly selecting samples

3) Method for reducing (or increasing) the frequency of sampling based on the number of consecutively acceptable samples or on the number of consecutively acceptable lots (or on the number of nonconforming items).

c. QA Control: The Sampling Plan shall be submitted to the A/E for approval prior to dedication inspection or testing (HOLD POINT).

3. QA Control: Dedication Inspections:

   a. Material dedication inspections shall be in accordance with Tables A2.1 and A2.2.

   b. In addition to the inspections of Tables A2.1 and A2.2, specific dedication inspections shall be as follows for selected items (initial sampling frequency same as Table A2.1, unless otherwise noted):

      1) W-Shape Segments (Including Inserts):

         - Uniformity of bend radius shall be verified by visually confirming that the curved segments do not have noticeably abrupt upsets or inflections. For steel sets with visibly noticeable discontinuities in bend radius, acceptability shall be based on the tolerance criteria of paragraph 2.02B.1.

         - Tie rod hole spacing and location shall conform to Figure 2.

         - Steel set installation shall conform to the requirements in specification paragraphs 3.02A.3 and 3.02B.1.

      2) Steel Set Welds:

         - Visual inspection of 100% of the connection and/or foot plate welds using welding inspectors certified in accordance with AWS D1.1, Section 6.1.3.1 shall be performed on randomly selected lot samples of steel set segments at receipt. The number of segments to have connection and foot plate welds inspected shall be based on the Reduced sampling plan of EPRI NP-7218, Table 2-1. Welds inspected may be the plate welds on the steel set segments sampled for other dedication inspections.

         - Acceptance criteria for welds shall be in accordance with AWS D1.1, paragraph 9.25.1 (1/32 inch undercut criteria applies to all welds).

4. QA Control: Normal dedication testing shall be performed in accordance with Table A2.1. Tests identified in the table are described as follows:

   a. Hardness Tests: Hardness tests shall be performed in accordance with ASTM A370, Sections 15 through 18, and the following:

      1) Hardness values used shall be the average of 3 tests at random locations on each sample tested. Minimum Brinell hardness values shall be as shown in Table A2.1.

      2) For carbon steel materials other than those shown in Table A2.1, Brinell hardness shall be derived from ASTM A370, Table 2B corresponding to the minimum required tensile strength for that material from the applicable ASTM standard.

3) Hardness scales other than the Brinell scale may be used by referring to ASTM A370, Table 2B to convert the Brinell number to the other scales.

b. Magnet Test: Confirm attraction of the magnet to the steel.

c. Destructive tensile tests and/or proof load tests (see Table A2.1) shall be performed on bolts/studs, tie rods (optional), and nuts as follows:

1) Randomly selected bolt and/or stud samples shall be tested for tensile strength in accordance with ASTM F606, Section 3. As a minimum, the number of samples destructively tested for tensile strength shall be in accordance with ASTM A307, paragraph 8.4.

2) As an alternative to hardness and magnet testing on tie rods (or tie rod plus nuts), random samples may be tested for tensile strength in accordance with ASTM F606, Section 3 (modified as needed if Constructor elects to test tie rod with nuts attached). As a minimum, the number of samples destructively tested for tensile strength shall be in accordance with ASTM A307, paragraph 8.4.

3) Randomly selected nut samples shall be tested for proof load stress in accordance with ASTM F606, Section 4. As a minimum, the number of samples destructively tested for proof load stress shall be in accordance with ASTM A563, paragraph 9.3. If the tie rod nuts are tension tested in combination with the tie rods, the requirements in this subparagraph are waived.

5. QA Control: Supplemental Dedication Testing:

a. Supplemental tests, if used as an alternative method for verifying material critical characteristics, shall include the following destructive mechanical tests (using lot sample acceptance methodology for destructive testing as described in the Constructor's A/E approved Sampling Plan) as applicable:

1) Mechanical testing of ASTM A36/A36M "Q" structural steel shapes and plates in accordance with the procedures described in ASTM A370, Section 13 for minimum tensile and yield strengths and Section 14 for bend test.

2) Mechanical testing of ASTM A53 "Q" pipe spacers in accordance with the procedure described in ASTM A370, Section A2.2 for tensile strength and Section A2.5.1.6 for bend test.

TABLE A2.1. MATERIAL DEDICATION TESTING AND INSPECTION REQUIREMENTS

Item	Brinell Hardness	Magnet Test	Head Mark [1]	Grade Mark [2]	Tensile Test	Proof Load	Sampling Frequency [3,4]	Remarks
W-Shape Segments & Inserts	119	x					Normal	
Foot & Connection Plates	119	x					Reduced	
Shim Plates		x					Reduced	
Connection Assy Bolts/Studs			x		x		Reduced	Tensile test per Para C.4.c
Connection Assy Nuts				x		x	Reduced	Proof load test per Para C.4.c
Channel Lagging Beams	119	x					Reduced	
Tie Rods	121	x			x [5]		Normal	Tensile test per Para. C.4.c
Tie Rod Nuts				x		x	Reduced	Proof load test per Para C.4.c
Pipe Spacers	123	x					Reduced	

FOOTNOTES:
[1] Shall comply with ASTM A307, Section 13.
[2] Shall comply with ASTM A563, Section 13.
[3] Initial sample frequency indicated is for non-destructive examinations based on Table 2-1 of EPRI NP-7218.
[4] Sample frequency of destructive tensile and proof load tests shall be per paragraph C.4.c.
[5] Tensile test is optional (may be used in lieu of hardness and magnet tests).

TABLE A2.2. STANDARD DIMENSIONAL MATERIAL DEDICATION INSPECTIONS [4]

Item	Dimensions Inspected at Receipt [1,4]								Acceptance Criteria
	d	b_f	A[5]	Wt[5]	t	W	L	D	
W-Shape Segments & Inserts [2]	x	x	x	x					ASTM A6/A6M, Table 16 and Section 13.3.3
Foot & Connection Plates [3]					x	x	x		ASTM A6/A6M, Tables 1 & 3 through 5 (as applicable)
Shim Plates					x	x	x		ASTM A6/A6M, Tables 1 & 3 through 5 (as applicable)
Connection Assy Bolts/Studs								x	ASTM A307, Section 7
Connection Assy Nuts					x	x[6]			ASTM A563, Section 7
Channel Lagging Beams [2]	x	x	x	x					ASTM A6/A6M, Table 16 and Section 13.3.3
Tie Rods								x	ASTM A307, Section 7
Tie Rod Nuts					x	x[6]			ASTM A563, Section 7
Pipe Spacers					x			x	ASTM A53, Sections 15, 16, and Table X2.2

FOOTNOTES:

1 Dimensions: d = depth; b_f = flange width; t_f = flange thickness; t_w = web thickness; A = cross-sectional area; Wt = section weight; W = width; L = length; D = diameter.

2 Inspect dimensions at a minimum of one randomly selected location per sample.

3 Minimum of one plate on each segment sample requires dimensional inspection.

4 Minimum initial sample frequency is provided on Table A2.1.

5 Either cross-sectional Area or Weight shall be within the limits specified (check only if t_f & t_w < AISC M016 average dimensions).

6 Width across flats

TABLE A2.3. CRITICAL CHARACTERISTICS SELECTED FOR MATERIAL DEDICATION

Item	Tensile Strength [1]	Proof Load Stress [1]	Dimensional Standard [2]	Markings
W-Shape Segments & Inserts [3]	58 ksi		ASTM A6/A6M	
Foot & Connection Plates	58 ksi		ASTM A6/A6M	
Shim Plates	58 ksi		ASTM A6/A6M	
Connection Assy Bolts/Studs	58 ksi		ASTM A307	Head
Connection Assy Nuts		175 ksi	ASTM A563	Grade
Weld Electrodes	70 ksi		AWS D1.1	
Channel Lagging Beams	58 ksi		ASTM A6/A6M	
Tie Rods	58 ksi		ASTM A307	
Tie Rod Nuts		175 ksi	ASTM A563	Grade
Pipe Spacers	60 ksi		ASTM A53	

FOOTNOTES:
[1] Minimums.
[2] Critical Dimensions are shown in Table A2.2.
[3] Also see paragraph C.3.b in this attachment.

END OF SPECIFICATION SECTION

CRWMS/M&O

Design Analysis Cover Sheet

Complete only applicable items.

(1.) QA: L

2. DESIGN ANALYSIS TITLE			
ESF GROUND SUPPORT - STRUCTURAL STEEL ANALYSIS			
3. DOCUMENT IDENTIFIER (Including Rev. No.) BABEE0000-01717-0200-00003 REV 02			4. TOTAL PAGES 22
5. TOTAL ATTACHMENTS 10	6. ATTACHMENT NUMBERS - NO. OF PAGES IN EACH I-174, II-62, III-124, IV-3, V-6, VI-9, VII-10, VIII-27, IX-19, X-33		

	Printed Name	Signature	Date
7. Originator	Thomas Misiak	M. E. Taylor for	6-26-96
8. Checker	Matthew Gomez	J Salehak for	6-26-96
9. Lead Design Engineer	M. E. Taylor, Jr.	M. E. Taylor, Jr.	6-26-96
10. QA Manager	H. GRIFFITH	Hyde Griffith	6/26/96
11. Department Manager	J. L. Naaf	Jerry L Naaf	6-26-96

12. REMARKS

1. TBV-193-ESF: Seismic design values for steel sets to be verified.
2. TBD-147-ESF: Thermally-induced stresses in the steel sets (or lining) to be determined.
3. TBD-154-RDR: Upgrades (if needed) to linings and ground supports due to a credible explosion and fire will be determined after completion of risk assessment.
4. TBV-069-DD: Rock mass strength estimates for TSw1 and TSw2 (for all rock categories 1-5) are non-qualified and to be verified.
5. TBV-073-DD: Depth of stations analyzed in Reference 5.20 to be verified and may affect rock loads.
6. TBD-146-ESF: Thermal load requirements to be determined later for design of steel sets.

INFORMATION ONLY

2. DESIGN ANALYSIS TITLE	
ESF GROUND SUPPORT - STRUCTURAL STEEL ANALYSIS	
3. DOCUMENT IDENTIFIER (Including Rev. No.)	
BABEE0000-01717-0200-00003 REV 02	

4. Revision No.	5. Description of Revision
02	Main body of analysis: Miscellaneous editorial revisions. Revised sections 4.2, 7.1, 7.7, 8.3 to reflect the ESFDR changes. Revised Section 6.5 to include Software Configuration Management. Revised sections 8.7.3 III.E and 8.7.10 to reflect changes made to the W8 x 31 baseplate offset and finite element analysis. Revised Section 8.5 E to reflect changed tie rod spacing. Attachment III: Deleted pages III-63 and III-64, (replaced by III-65) and pages III-73, III-74, and III-75 (stiffeners not required). Revise page III-60 for hole size. Revised pages III-65, III-67, III-68, III-69, III-70, III-71, and III-72, to reflect the 3/4-inch chamfer of the concrete invert segment curb. Revised page III-76 to delete stiffners. Revised pages III-82, III-83, and III-84, to reflect 3/4-inch chamfer and determine offset based on bearing pressure. Revised page III-102 to reflect changed fillet weld thickness. Revised page III-113 to remove shear tab. Attachment VII: Revised pages VII-3 and VII-4 to reflect changed tie rod hole group spacing and tie rod spacing. Attachment IX: Revised page IX-6 to reflect changed tie rod hole group spacing and tie rod spacing. Revise page IX-16, IX-17, and IX-18 to remove stiffners. Attachment X: Revised entire contents to reflect the 3/4-inch chamfer of the concrete invert segment curb.

1. PURPOSE

1.1 The purpose and objective of this analysis are to expand the level of detail and confirm member sizes for steel sets included in the Ground Support Design Analysis, Reference 5.20. This analysis also provides bounding values and details and defines critical design attributes for alternative configurations of the steel set. One possible configuration for the steel set is presented. This analysis covers the steel set design for the Exploratory Studies Facility (ESF) entire Main Loop 25-foot diameter tunnel.

1.2 This analysis includes design calculations for the following ground support structural members, components, and features. Also included are associated tolerances, design sketches, and computer output data (attachments where calculations are found are in parentheses after each item):

A. Steel Sets (I, III.A and VIII)
B. Steel lagging (III.B)
C. Tie rod and pipe spacer (III.D)
D. Steel set foot plate (III.E)
E. Steel set connection to insert (III.G)
F. Connection between steel set segments (III.G)
G. Inserts (III.C)
H. Steel set foot segments (III.H and III.I)
I. Shim plates (III.K)
J. Steel wedges (III.L)
K. Jacking bracket assembly and bolted connection to steel set (III.C and VI)
L. Tolerances (VII)
M. Summary of Design Sketches (IX)
N. FLAC Computer Output (II)

2. QUALITY ASSURANCE

2.1 The quality assurance (QA) classifications for structural steel ground support in this analysis are presented in QA Classification Analysis of Ground Support Systems, Configuration Item (CI): BABEE0000 (Reference 5.5).

2.2 The following structural steel ground support components are permanent and are classified QA-1 and QA-5:

A. Steel set
B. Steel lagging
C. Tie rod and pipe spacer
D. Steel set foot plate
E. Steel set connection to insert
F. Connection between steel set segments
G. Insert

H. Steel set foot segments
I. Shim plate

2.3 Wedges, blocking, backfill or other materials placed in voids to transfer the rock load to the steel sets are considered to be non-quality affecting. (In commercial tunnels, blocking and wedges are typically made from timber; material strength is not considered to be a critical parameter.) These materials can be thought of as a substitute for rock originally occupying the void space, for which there is no relevant QA classification.

2.4 The following structural component is temporary and is not subject to the requirements of the project QA program: jacking bracket assembly and bolts used for the connection to steel set.

The jacking brackets and connection will be used during installation of steel sets only. Since the brackets have no permanent ground support function, they are not considered important to waste isolation or radiological safety.

3. METHOD

3.1 The steel set is analyzed for two basic conditions:

3.1.1 Installation/jacking process associated with erecting the steel sets after the ground has been excavated by the tunnel boring machine (TBM)—the computer software STAAD-III/ISDS (See Section 6, Use of Computer Software) is used to analyze steel sets and verify size of steel members as noted in Section 3.2.

3.1.2 Long-term rock load condition—the long-term rock load analysis, including utility and seismic loads, was determined in ESF Ground Support Design Analysis (Reference 5.20). The resulting forces and moments were then used for the design of the steel set and components, noted in Section 3.2.

3.2 The steel set and other components listed in Section 1.2 are designed by hand calculations and computer analyses using the results of the ESF Ground Support Design Analysis (Reference 5.20) outputs, installation/jacking loads, and other inputs listed in Section 4.

4. DESIGN INPUTS

4.1 DESIGN PARAMETERS

4.1.1 Seismic - Mean Peak Horizontal and Vertical Acceleration = 0.37g (TBV-193-ESF). (Appendix A, Page A-2, Table A-2, Reference 5.16).

4.1.2 Rock Mass Properties (Reference 5.20, Pages 5 through 10) as used in design of lagging (Attachment III.B):

Geologic Unit	Mean Density		Minimum Friction Angle[(1)]
	Kg/m^3	lb/ft^3	
TCw	2115	132	53°
PTn	1268	80	40°
TSw1	2207	138	41°
TSw2	2257	141	49°

(1) Friction Angles are non-qualified data (TBV-069-DD)

4.1.3 Precast Concrete Dimensions - Drawings (References 5.7 and 5.8). Dimensions used in this analysis were:

- Curb face angle = 31.01° (±) 0.02°
- Invert segment width = 48 in. (1220 mm)
- Curb width = 7 ½ in. (191 mm) (Bearing width = 7 ½ in. - ¾ in. = 6 ¾ in)
- Chamfer ¾ in. (19 mm) on front of curb face
- Notch dimension on back of curb face = ½ in. x 3 in. (13 mm x 76 mm)
- Minimum side cover on bars = 1½ in. (38 mm)
- Base thickness = 28⅛ in. (715 mm)
- Curb rebar is as shown on References 5.7 and 5.8

4.1.4 The configuration of the steel sets was developed through numerous meetings and discussions between the Architect/Engineer (A/E) and Constructor and previous revisions of this analysis. Details were refined to accommodate construction methods and the installation processes.

4.1.5 The dimensions for the jacks used in this analysis for the design of the jacking bracket are from References 5.18 and 5.19 and are as follows (see Attachment VI):

25 ton jack for W8 steel set and 15 ton jack for W6 steel set:

Feature	25 Ton Jack (W8)		15 Ton Jack (W6)	
	HSR-258T	HSR-2510T	HSR-156T	HSR-1510T
Capacity	25 Ton	25 Ton	15 Ton	15 Ton
Stroke	8¼ in.	10¼ in.	6 in.	10 in.
Closed Height	12¾ in.	14¾ in.	10 11/16 in.	14 11/16 in.
Body Dimension	3⅜ in.	3⅜ in.	2¾ in.	2¾ in.

4.1.6 ESF Tunnel Main Loop maximum grade is 2.567 percent (Reference 5.12).

4.1.7 Not used.

4.1.8 Not used.

4.1.9 ESF Tunnel Main Loop Diameter = 7.62 meters (25 feet) nominal (Reference 5.12).

4.1.10 Force results in steel set from ESF Ground Support Design Analysis (Reference 5.20). Axial forces, moments and shears are provided at various locations (nodes) throughout the steel set. This output from Reference 5.20 has been included as Attachment II to the analysis.

4.1.11 Not used.

4.1.12 Specified Compressive Strength of Concrete f′c = 34.5 MPa (5,000 pounds per square inch [psi] Reference 5.21).

4.2 CRITERIA

The following design criteria, applicable to this analysis, were developed in response to requirements in the Exploratory Studies Facility Design Requirements (ESFDR) document (Reference 5.16).

4.2.1 The permanent and temporary components of the ESF structural steel ground support system shall be designed to withstand the applicable seismic environment specified in Appendix A of the ESFDR. The seismic loads were determined in the analysis of Reference 5.20 (also see Attachment II), and the steel sets were designed (Attachment III) to withstand these loads (ESFDR 3.2.1.2.1.2.A).

4.2.2 ESF non-permanent structural steel ground support items shall be designed for a 25-year maintainable service life. ESF permanent structural steel ground support items shall be designed for a 150-year maintainable service life. These criteria are addressed (see Section 7.1) by the selected design of the steel sets and accessories using exposed carbon steel W-shape bolted ring beams with channel lagging which allow for ease of accessability for maintenance and/or replacement (ESFDR 3.2.1.2.2.A and B).

4.2.3 The ESF structural steel ground support system shall be designed in compliance with the applicable requirements contained in DOE Order 6430.1A. The applicable criteria, i.e., Division 1 (General Requirements), Sections 0111-1 (General), 0111-2 (Loads), 0111-3 (Structural Systems for Buildings and Other Structures), 0111-99 (Special Facilities); Division 5, Sections 0512-1 (Structural Steel for Buildings and Other Structures), and 0532 (Metal Fastenings); and Division 13, Sections 01300-1 (Coverage and Objectives), and 01300-3.2 (Safety Class Items) are addressed throughout this analysis (ESFDR 3.2.1.2.4.C).

4.2.4 Records shall be developed and maintained, including as-built documentation, for location and description of the ESF structural steel ground support systems. This criterion is addressed in Section 7.1 with appropriate requirements for as-built documentation to be furnished by the Constructor included in the construction specification for the steel sets (ESFDR 3.7.1.2.B).

4.2.5 The ESF structural steel ground support system will support the testing requirements. This criterion is addressed (see Sections 7.1 and 7.7) by spacing and configuring the steel sets and lagging to allow access to the rock, as needed, to accommodate testing requirements (ESFDR 3.7.3.1.A).

4.2.6 The ESF structural steel ground support system will be compatible with the excavation methods and equipment. This criterion is addressed (see Section 7.1) by selecting a steel set and lagging system that is compatible with the tail shield configuration of the Tunnel Boring Machine (TBM) (ESFDR 3.7.3.1.D).

4.2.7 The ESF structural steel ground support system shall incorporate the use of noncombustible and heat resistant materials in the design. This criterion is addressed (see Sections 7.1 and 7.7) by specifying carbon steel for all permanent components of the steel set assemblies (ESFDR 3.7.3.1.E).

4.2.8 The ESF structural steel ground support system shall limit the use of selected tracers, fluids, and materials. This criterion is addressed (see Sections 7.1 and 7.7) by limiting the use of cementitious, organic, and combustible materials. Carbon steel is used as the primary ground support material, and the use of wood wedges and blocking is minimized and will be recovered to the extent practical (ESFDR 3.2.1.2.3.B).

4.2.9 The ESF structural steel ground support system shall be designed to permit periodic inspection, monitoring, testing, and maintenance, as necessary to evaluate their readiness and to ensure continued function. In addition, the ESF structural steel ground support system will be designed and installed throughout the main access openings and all alcove transition zones to reduce the potential for deleterious rock movement or fracturing. This criteria is addressed (see Sections 7.1 and 7.7) by the selection of bolted structural steel sets, lagging and accessories for the primary ground support system under the worst case rock load conditions. In addition, Reference 5.20 analyzes the potential for deleterious rock movement or fracturing. Finally, the ground support system, once installed, will be readily accessible for routine observation, maintenance, and/or replacement in whole or in part to ensure continued function (ESFDR 3.7.3.1.F and G).

4.2.10 The ESF structural steel ground support system shall be designed to accommodate anticipated ground conditions utilizing available site data, to have the capability to be supplemented as required when identified through additional site characterization data and analyses, and to have sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions encountered during excavation or identified through in situ monitoring and testing. These criteria are addressed (see Section 7.1) by the selection of bolted structural steel sets, lagging and accessories for the primary ground support system under the worst case rock load conditions as developed in Reference 5.20. In addition, this type of ground support system provides flexibility by allowing adjustment to the supports (or supplementing the supports with additional supports as needed) to accommodate rock conditions encountered (ESFDR 3.7.3.1.I, J, and K).

4.2.11 The ESF structural steel ground support system shall be designed to meet predicted thermal and thermomechanical response of the host rock, surrounding strata, and groundwater system for the site characterization heater tests. This criteria will be addressed when thermal load criteria have been established (TBV-146) as a result of the heater alcove tests. Thermal effects will be incorporated into the Reference 5.20 analysis, and then translated into changes to the design of the steel sets and accessories, if needed (ESFDR 3.7.3.1.L).

4.3 ASSUMPTIONS

4.3.1 Not used.

4.3.2 Not used.

4.3.3 Not used.

4.3.4 Not used.

4.3.5 Not used.

4.3.6 Credible fire and explosion design bases for the repository design are to be determined (TBD-154-RDR). However, the design of the steel sets for the ESF does not preclude the future incorporation of design features which would mitigate the effects of a credible fire or explosion in the repository.

4.4 CODES AND STANDARDS

4.4.1 American Concrete Institute (ACI)

ACI 318-89	Building Code Requirements for Reinforced Concrete (ACI 318-89, Revised 1992) and Commentary (ACI 318R-89, Revised 1992).
ACI 301-89	Specifications for Structural Concrete for Buildings

4.4.2 American Institute of Steel Construction (AISC)

AISC M016-89	AISC Manual of Steel Construction, Allowable Stress Design, Ninth Edition (First Revised Printing, January 1991)

4.4.3 American Society of Mechanical Engineers (ASME)

ASME B18.5-90	Round Head Bolts (Inch Series)

4.4.4 American Society for Testing and Materials (ASTM)

ASTM A6/A6M-94a	Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
ASTM A36/ A36M-94	Standard Specification for Carbon Structural Steel
ASTM A53-94	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A307-94	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A325-94	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 kips psi ksi Minimum Tensile Strength
ASTM A490-93	Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A563-94	Standard Specification for Carbon and Alloy Steel Nuts
ASTM F436-93	Standard Specification for Hardened Steel Washers

4.4.5 American Welding Society (AWS)

AWS A5.1-91	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1-94	Structural Welding Code-Steel, Thirteenth Edition

4.4.6 Not used.

4.4.7 Not used.

4.4.8 United States Department of Energy (DOE)

DOE 6430.1A General Design Criteria

5. REFERENCES

5.1 Subsurface Fire Hazard Analysis, BABFAH000-01717-0200-00121 REV 00.

5.2 Impact Review Action Notice, J. Pye to D. Rogers, August 2, 1995.

5.3 Commercial Pantex Sika, Inc. Catalog, Structural Steel Supports, no date.

5.4 Subsurface General Construction, BAB000000-01717-6300-01501 REV 04.

5.5 QA Classification Analysis of Ground Support Systems (CI: BABEE0000), BABEE0000-01717-2200-00001 REV 02.

5.6 Not used.

5.7 Rail Placement Invert Segments - B, Plan & Sections, Drawing BABFCC000-01717-2100-41100 REV 03.

5.8 Rail Placement Invert Segments - A, Plan Sections & Details, Drawing BABFCC000-01717-2100-41099 REV 03.

5.9 Not used.

5.10 *Software Requirements Document for Structural Analysis and Design/Integrated Structural Design System* (STAAD-III/ISDS), Version 4-8 MB, Rev. 16.0, Computer Software Document Number: SRD-02, Revision 0, Computer Software Configuration Item (CSCI) Number 20.93.3002-AAU4-8MB.

5.11 Not used.

5.12 ESF Layout Calculation, BABEAD000-01717-0200-00003 REV 03.

5.13 Not used.

5.14 Not used.

5.15 Retrieval Conditions Evaluation, BCA000000-01717-5705-00003 REV 00.

5.16 Yucca Mountain Site Characterization Project, *Exploratory Studies Facility Design Requirements*, Rev. 02, YMP/CM-0019.

5.17 Beer, F. P. and E. R. Johnston, Jr., Vector Mechanics for Engineers STATICS AND DYNAMICS, McGraw-Hill, NY, 1962.

5.18 Simplex Catalog SC101, Hydraulic and Mechanical Power, 1995.

5.19 TK SIMPLEX Catalog, Hydraulic and Mechanical Jacks for Industry, 1990.

5.20 ESF Ground Support Design Analysis BABEE0000-01717-0200-00002 REV 00 (TBV-069-DD, TBV-073-DD, TBD-146-ESF and TBD-147-ESF).

5.21 Precast Concrete Specification, BABFCC000-01717-6300-03480 REV 00.

5.22 Non-Gassy Mine Classification Analysis, BABE00000-01717-0200-00115 REV 00.

6. USE OF COMPUTER SOFTWARE

6.1 Basis for Computer Use: The steel set (W8 or W6 shape) is a symmetrical arch frame which is a statically indeterminate structure subject to a variety of loading conditions. The general approach to the problem of analysis of statically indeterminate structures with different loading conditions is to utilize the accuracy and speed of the computer to efficiently derive the forces, reactions and moments for the steel set and the size of the W8 or W6 shape using an appropriate indeterminate structural analysis.

6.2 Computer inputs and outputs are presented in Attachments I and II. The steel set W8 or W6 shape is analyzed and initially checked by computer in these attachments. The initial computer check is verified by hand calculation. The permanent attachments and connections are designed by hand calculations (Attachment III) using the maximum axial forces, shears, and moments from the computer analysis output.

6.3 Computer hardware used for this analysis - IBM Compatible 486/33 MHz.

6.4 STAAD-III/ISDS, Version 4-8MB, Rev. 16.0 (Reference 5.10), CSCI No. 20.93-3002-AAu4-8MB, is the computer software used for this analysis. The computer software has been validated, verified, and controlled in accordance with applicable Management and Operating Contractor procedures.

6.5 The computer software used in this analysis is appropriate for this application since the STAAD-III program was specifically selected and validated for the purpose of analyzing and designing the steel sets and accessories. The program was used within the validated range as described in the verification and validation documentation. The program was obtained from Software Configuration Management in accordance with appropriate procedures.

6.6 Attachment II contains results of computer runs presented in Reference 5.20. For FLAC Version 3.22 Verification and Validation (V&V) information, see Reference 5.20.

6.7 In addition to the software noted above (STAAD-III, FLAC), computational support software as defined in Quality Administrative Procedure, QAP-SI-0, *Scientific and Engineering Software*, used in this analysis was Lotus 1-2-3, Release 4 for Windows. The spreadsheet feature of Lotus 1-2-3 was used in Attachment III.I to tabulate and perform repetitive calculations for shear and sliding resistance calculations at the base of the steel sets. User defined formulas, inputs and results are shown in the attachment. Also, WordPerfect Release 5.2+ for Windows was used throughout the analysis to tabulate data (no calculations) and present information.

7. DESIGN ANALYSIS

7.1 INTRODUCTION

Steel sets comprised of wide-flange structural shapes have been selected as an appropriate ground support system (including general configuration and spacing) in the ESF Ground Support Design Analysis (Reference 5.20).

The ESF ground support structural steel analysis is based on two conditions. The first condition is the installation/jacking process associated with erecting the steel sets after the ground has been excavated by the TBM. The second condition is the long term operating conditions for the steel set, which includes the long term rock loading and the various utility service support loads. Of these two conditions, the second (Reference 5.20) establishes the starting point for the analysis of the structural steel.

The circular shape of the steel set is based on the excavated diameter of the tunnel as set by the TBM. Spacing of the steel sets was established (in Reference 5.20) at 1.22 m (4 feet) center to center, nominally, based on construction and equipment limitations associated with the weight and size of the ground support segments and nominal steel set sections commonly associated with a tunnel of this size and the excavation method. Where weaker ground is encountered requiring heavier steel support, the spacing of the steel sets is reduced to 0.61 m (2 feet). With this reduced spacing the steel set configuration would remain the same as that used at 1.22 m (4 feet) spacing, but the lagging span would decrease to provide a stronger support system for the higher rock loads.

The configuration of the steel set used in this analysis was developed during (undocumented) review meetings between the A/E and Constructor and previous revisions of this analysis. A multiple piece set was selected to facilitate handling and erection within the tunnel. The steel set was configured into three large segments (one crown segment and two wall segments) and two small segments, i.e., the foot segments (see Steel Set Detail, Alternate I, Attachment IX). The three large segments provide ground support for the tunnel crown and walls. The two small segments are an extension of the wall segments and have a foot plate on one end that rests on a precast concrete invert foundation. An insert and shims or shims alone are placed between the wall segments and foot (small) segments upper plates during expansion of the steel set. As an alternative steel set configuration (see Steel Set Detail, Alternate III, Attachment IX), the two wall segments are extended and the two foot segments that rest on the precast concrete invert foundation are reduced. Inserts and shims are placed between the wall segments and the foot segment upper plate during the expansion/jacking process.

As shown in Attachment IX, Alternate I consists of a longer foot segment with a jacking bracket near the upper end. A similar jacking bracket is attached to the lower end of the wall segment. The brackets are aligned such that the reaction line of the jacking force passes through the center part of the foot segment base plate, thus eliminating any eccentricity on the foot segment base plate and ensuring stability of this member for personnel safety during the jacking operation. In addition, only shim plates are used between the foot segment and the wall segment.

Alternate III in Attachment IX represents the jacking bracket design as used in the tunnel to date. This configuration requires an insert segment and shim plates between the foot segment and wall segment. The jacking brackets, though similar in design to Alternate I, are aligned such that an eccentric load is applied to the foot segment. To counteract this load and to ensure stability of the foot segment during jacking, a leg was added to the base plate to engage the inner face of the invert segment curb.

The final configurations of the steel set with detailed dimensions as analyzed herein are shown in Attachment IX. The configuration shown will provide relatively unrestricted access to the host rock to accommodate the needs of the testing community. The use of bolted carbon steel sets will also provide a ground support system compatible with the anticipated configuration of the repository. In addition, as shown in this analysis, the steel set system will control the configuration and stability of the opening, will protect personnel and equipment against potential falls of loose rock, will reduce the potential for deleterious rock movement or fracturing, and will be compatible with the excavation methods and equipment (TBM).

The tunnel is judged to not be a corrosive environment because of the generally dry conditions (Reference 5.15, Section 6.3.2.2), therefore corrosion allowance beyond reserve capacity of the steel members is not considered necessary.

Although individual steel sets cannot be guaranteed to last for the design life of 150 years they have been designed for a "maintainable life" of 150 years. This means that steel sets exhibiting obvious signs of deterioration or distress can accommodate removal and replacement either with other steel sets of like kind or with other means of ground support. Similarly, the steel sets as presently designed do not preclude future methods of rock support for repository loads, e.g., a concrete lining with steel sets remaining in place as non-functioning members.

It should be noted that the detailed configuration of the steel sets and accessories as presented in this analysis represent only a few of the many acceptable alternatives that could be considered for steel sets to be used in the ESF. The Constructor will be encouraged to develop and submit alternative details to facilitate construction, which will be subject to A/E approval, as long as the critical attributes as identified in Section 8.5 are met. In addition, the construction specifications will require that the Constructor develop and maintain records, including as-built documentation, for location and description of all structural support systems, e.g., steel sets.

7.2 STEEL SET JACKING

The purpose of jacking the steel set is to bring the profile of the steel set and lagging into positive contact with the excavated profile to support rock loads resulting from the excavation process. The steel set was analyzed to establish the maximum jack forces for the jacking operation based on the jacking bracket configuration as depicted in Attachment IX. A (STAAD-III) computer analysis was performed to determine the effects of various jacking forces: 50^T, 30^T, 25^T, 20^T, and 15^T on the steel set and what the resulting stress ratios were for these forces using the AISC code check option of the STAAD-III software. Simultaneous jacking and one-sided jacking were analyzed to determine the governing condition. The computer input files and output results for jacking conditions are presented in Attachment I for the W8 x 31 and in Attachment VIII for the W6 x 20. The explanations of the loading conditions including loading points in the model, loading values and location of supports are presented in detail in Attachment I.

The jacking analysis used a structural model of the steel set with joints and members that accurately describe the steel set configuration as presented in Attachment IX. Supports/contact points were modeled to reflect the steel set's behavior during the jacking process. At the initial stage of the jacking operation, the steel set starts to make contact with the tunnel walls that provide horizontal support for the steel set from the bottom to about the spring line level. The distance between these horizontal supports is modeled to be at each fifth node (about 6 feet, engineering judgement based on observed field conditions), which conservatively reflects the positive contact requirements for steel set installation. No vertical support is provided below the spring line due to the fact that the steel set is moving upward during the jacking operation and only supports above the spring line could restrain this movement. As the jacking force increases, more contact is made at about mid distance between the spring line and the crown where the support has a horizontal as well as a vertical component. In the final stage, the crown makes contact with the steel set providing the vertical restraint required, which is represented in the model by two vertical supports close to and symmetric about the crown.

The self weight of the steel set was increased in the analysis to account for the additional weight of lagging and other components. No frictional forces were considered as part of the jacking analysis to ensure that the results were conservative and maximum stress for design could be obtained. The relative conservatism of the results is indicated by comparing preliminary strain gage data from the steel sets to design stresses (see Attachment IV).

7.3 LONG-TERM ROCK LOADING AND UTILITY SERVICES

The long-term rock loading analysis results (including utility and seismic loads) are included in Attachment II and were determined in Reference 5.20.

7.4 DESIGN SELECTION PROCESS

The analyses to support the design selection/confirmation process for the structural members, components, and attachments (outlined in Section 1.2) are presented in detail in Attachments I, III, and VIII. Calculations for all structural members, components, and attachments are presented under appropriate headings (with a reference to representative subsection in Section 1.2) in those attachments. A summary of the conclusions from all attachments are found in Section 8.7.

7.5 BOLTED CONNECTIONS

Requirements for bolted connections using ASTM A307 (as a minimum) are provided below:

> The bolted connections in this analysis were determined to be not slip-critical based on the fact that there is little impact, vibration, repetitive loads, load reversals, or high tensile forces in the steel set connections that would tend to reduce the friction between the joint plates (AISC M016, p. 5-270, Paragraph 5[a]). For this reason, torquing of the bolts will not be necessary beyond what AISC refers to as a "snug tight" condition.
>
> A307 bolts will be installed to a snug tight condition in accordance with AISC (Codes and Standards 4.4.2). In AISC, p. 5-303, "snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. In actuality, snug tight is a degree of tightness, which will vary from joint to joint depending upon the thickness and degree of parallelism of the connected material. In most joints the plies will pull together; however, in some joints, it may not be possible at snug tight to have contact throughout the faying surface area."
>
> In the AISC Commentary to Specifications for Joints Using ASTM A325 and A490 bolts, a discussion is presented on why separate installation procedures are now provided for bolts that are not within the slip critical or direct tension category. "The intent in making this change is to improve the quality of bolted steel construction and reduce the frequency of costly controversies by focusing attention, both during the installation and tensioning phase and during inspection, on the true slip-critical connections rather than diluting the effort through the requirement for costly tensioning and tension testing of the great many connections where such effort serves no useful purpose. The requirement for identification of connections on the drawings may be satisfied either by identifying the slip-critical and direct tension connections which must be fully tightened and inspected or by identifying the connections which need be tightened only to the snug tight condition."

Quotations found in the preceding two paragraphs are extracted directly from AISC p. 5-273, Paragraph 8.(c) and p. 5-303 for joints not within the slip-critical range nor subject to tension loads, respectively. The steel set is designed to be in ring compression, therefore, the load transferred at the joint is primarily a compressive force. As the full rock load develops, this compression load will tend to force the plates into contact.

AISC Section M4. Erection, Paragraph 4, p. 5-90 states: "Lack of contact bearing not exceeding a gap of 1/16-in., regardless of the type of connection used (partial-penetration, groove-welded or bolted), shall be acceptable. If the gap exceeds 1/16-in., but is less than 1/4-in., and if an engineering investigation shows sufficient contact area does not exist, the gap shall be packed with non-tapered steel shims. Shims may be of mild steel, regardless of the grade of the main material."

Engineering judgment indicates that, where gaps may exist in steel set segment connections, a minimal ring compressive force will occur. As the rock loading increases, sufficient contact will develop between the plates of the steel set joints to adequately transfer the ring compressive force. As the design compressive force is attained, the plates may come together as noted above. Snug tightness shall be in accordance with AISC, p. 5-303 except that gaps between connection plates and between connection plates and shims may exceed 1/16-in. if plates or plates and shims make contact at any point in the connection plane. Bolted steel set joints are compression connections with only minor moment and shear loads. While they are considered critical to the performance of the set, the relatively low loading in comparison to the size of bolts selected reduces the need for special testing to verify material characteristics of the bolts.

The field drilling of holes larger than 5/16-in. in the steel set members for bolting of miscellaneous connections on steel sets shall be in accordance with AISC Sections J3.1 and J3.5, and will be subject to A/E approval.

7.6 WELDED CONNECTIONS

To ensure the adequacy of welded connections, welding shall be performed in accordance with the requirements of AWS D1.1 using E70XX 70 ksi tensile strength (minimum) electrodes. Welders and weld procedures shall be qualified for the electrode(s) used in accordance with AWS D1.1, Section 5.

The member welds shown in the details of Attachment IX experience relatively low shear stress. Additional weld lengths are provided for connection stability. The flange welds on the W-shapes at connecting plates are provided to ensure that the connection plate and the W-shape work together effectively under both static and seismic load conditions, even though the jacking loads, in most cases, result in the worst case shears at the joints. Welded connections of plates and W-shapes are subject to only minor shear loads due to long term rock load or jacking. While the welds are considered critical to the performance of the set, the amount of welding specified herein, in relation to the minor loading resisted by the welds, reduces the need for special inspections and/or tests to verify the weld filler material characteristics.

7.7 CREDIBLE FIRE AND EXPLOSION

The ground support system (steel sets) has not been designed for credible fire or explosion loads during construction or operation of the ESF. This approach is based on the Subsurface Fire Hazard Analysis (Reference 5.1) which concludes that the potential for an explosion in the ESF is extremely unlikely. In addition, loss prevention and/or life safety concerns due to a credible fire during construction and operation of the ESF would be met by the (current and future) design of the fire suppression and alarm systems; the non-combustible nature of the ground support system; a ventilation system designed to meet life safety objectives; and the provision of refuge chambers. The ESF Design Basis Fire (DBF) is in the TBM itself (Reference 5.1), well ahead of the steel sets. If incorporated into the repository design, fire or explosion damage to the steel sets (if credible) would be localized, of short duration, and, at worst, might result in deformation of the steel sets and lagging but not total collapse of the tunnel. Repair and/or replacement of the steel sets may be needed, but would be relatively uncomplicated.

If a fire should occur in the ESF, it would be localized and of fairly short duration due to the fire suppression and alarm systems in place (see Section 4.3.6, above). AISC M016 (page 6-3) notes that the <u>average</u> temperature reading for steel members exposed to fire should not exceed 1000° F for columns and 1100° F for beams without considering insulating protection for the steel. Fire exposure of severity and duration sufficient to raise exposure temperatures above these limits would seriously impair the ability of the steel members to sustain loads. Although exposure temperatures could conceivably exceed the above limits during a fire, it is judged that fire-proofing of the steel sets and lagging is not required. Fire proofing would be costly, could interfere with the in situ site characterization testing, would obscure the ground support system thus preventing periodic inspection and maintenance, could interfere with incorporating the ground support system into the eventual repository, and would introduce additional undesirable cementitious materials into the ESF environment. In addition, should a fire occur in the ESF or in the repository, resulting in high exposure temperatures to the steel members and subsequent degradation of the steel sets or even localized (though unlikely) failure of the support system, the debris could (as noted above) be cleared and the ground support systems replaced within a reasonably short period of time, thus minimizing the impact on the ESF construction/operational activities and on the repository functions.

8. CONCLUSIONS

8.1 The ESF ground support steel set configuration and details analyzed herein are summarized in Attachment IX. The steel set member sizes and spacing used in the ESF ground support are presented in Table 14 of Reference 5.20.

8.2 Based on the jacking configuration presented in Attachment III.C, the maximum jack load/force on the W8 x 31 is 27 tons (Attachment I) and on the W6 x 20 is 17 tons (Attachment VIII). The jacking load may be applied to both sides of the steel set simultaneously or to only one side of the steel set.

8.3 The steel sets are adequate for use in the construction of a stable, functional opening with a 150 year maintainable life (see Section 7.1).

8.4 The installation tolerances for the steel sets along the longitudinal direction of the tunnel are presented in Attachment VII. The established tolerances contribute no significant decrease to the capacity of the steel sets or components.

8.5 As noted in previous sections, the results of this analysis present only a few of the many acceptable methods that could be used for steel sets in the ESF. The Constructor will be encouraged to develop and submit alternative solutions for A/E approval as long as minimum critical design attributes are met. For the purposes of this analysis critical design attributes are defined as those important design, material, and performance attributes as delineated herein that require verification to provide reasonable assurance that the item will perform its intended safety function. From these critical design attributes, (1) "critical characteristics" of the items are selected and verified through material dedication (separate analysis), and (2) identifiable and measurable or qualitative critical performance attributes necessary for the item to function as intended will be defined for development of installation and inspection requirements.

The Constructor shall incorporate the following minimum critical design attributes into alternative solutions submitted.

A. Member Sizes and Material Properties

The steel set members and materials shall be of the following (members or materials of equal or greater strength may be substituted):

1. Steel set ring beam members shall be either W8 x 31 or W6 x 20, consistent with rock conditions shown in Table 14 of Reference 5.20, with material properties conforming to ASTM A36.

2. Steel lagging shall be C8 x 11.5, with material properties conforming to ASTM A36.

B. Steel Set Configuration

The bend radius of the steel set shall be of uniform contour, shall facilitate placement, and shall be compatible with the nominal 25 feet - 0 in. diameter of the tunnel such that the set engages or contacts the rock perimeter (via the lagging when expanded or blocked into the final configuration) to the extent practical (i.e., consistent with standard industry practice).

1. The steel sets shall be founded on the curbs of the concrete invert segments (see Attachment III.E).

2. The steel sets shall be spaced based on the rock conditions encountered, either 2 feet, 4 feet, or 6 feet nominal (see Table 14 in Reference 5.20).

3. The quantity and location of steel set joints shall be determined by the Constructor, subject to A/E approval of shop drawings.

C. Lagging

Lagging shall be configured such that it can transfer the rock loads to the steel set ring beam.

Lagging details are shown in Attachment III.B.

D. Not used.

E. Tie Rods

Since the tie rods are primarily designed to carry tension loads, they shall be provided with a compression brace (pipe spacer) capable of maintaining the steel set spacing. Tie rod general arrangement will be as shown in Attachment III.D with the following critical attributes:

1. 35° maximum angle between tie rods (± 1")
2. 7° maximum from foot segment base plate
3. Locate at ½" inside of centerline of W-shape (+/-) ⅜ in.

F. Jacking/Expansion of Steel Sets

The steel sets shall be jacked into final position using hydraulic jacks or other means that will provide reasonably uniform expansion of the steel set against the tunnel walls and crown to provide positive contact to the extent practical, i.e., consistent with standard industry practice. The jacking process shall not overstress the steel set. The jacking brackets shown in Attachment III.C represent one jacking method that will work, but should not constrain the Constructor from developing other systems for expanding the steel sets that meet the requirements of this paragraph.

G. Connections

Connections and connecting components (plates, nuts, bolts, shims) shall be sufficient to provide continuity in the entire steel set when loaded (primarily) in ring compression.

Steel set joint connection details shall be as shown in Attachment III.G.

8.6 The ESF has been determined to be a nongassy tunnel (Reference 5.22), and therefore explosion from methane or other explosive gasses are not credible events. The Importance to Safety Ground Support and Lining items classified QA-1 and QA-5 begin their intended radiological safety function at the beginning of the repository phase when waste packages are placed. Therefore, the use of explosives during the construction of the ESF has no impact on the design of steel sets to perform their intended safety function. The use, the amounts transported and stored, and the logistics and associated risk assessment of explosives in the potential repository have yet to be determined. Design for effects of explosions cannot proceed without the above determination being performed (TBD-154-RDR). However, current design does not preclude the installation of reinforcement to allow the linings and ground support to meet credible fire and explosion criteria developed and analyzed during Repository design.

8.7 SUMMARY OF CONCLUSIONS FROM ATTACHMENTS

8.7.1 Attachment I

- W8 x 31 selected is confirmed as an acceptable steel set member size for up to a 27 ton jack load
- Jacking centerline to be maximum of 6 in. from W8 X-X axis, based on the configuration used in Attachment III.C and shown in Attachment IX.
- One-sided jacking is acceptable.

8.7.2 Attachment II

- Output results from FLAC analysis (Reference 5.20), no conclusions.

8.7.3 Attachment III

- III.A: W8 x 31 steel set is adequate for up to a 27 ton jacking force and for rock loads, utility load, and seismic loads.
- III.B: C8 x 11.5 lagging is adequate for rock loads plus seismic loads.
- III.C: Jacking bracket assembly as shown is adequate for up to a 27 ton jack load for W8 x 31 and up to a 17 ton jack load for W6 x 20.
- III.D: ¾-in. diameter tie rod spaced at 35° (in combination with 1½-in. diameter pipe spacer) is sufficient to laterally brace the steel sets.
- III.E: Steel set foot plate as shown is adequate for the average axial load in the steel set. Maximum offset allowed is 1 inch.
- III.F: Steel set foot segment as shown is adequate for up to a 27 ton jack load for W8 x 31 and up to a 17 ton jack load for W6 x 20.
- III.G: Steel set splice connection as shown is adequate.

- III.H: Steel set foot segment (2 alternatives) are stable under 27 ton (max.) jack load for W8 x 31 and 17 ton (max.) jack load for W6 x 20.
- III.I: Not used.
- III.J: Not used.
- III.K: Shim plate thicknesses and configuration as shown are adequate.
- III.L: Steel wedge as shown is adequate for blocking of steel set.

8.7.4 Attachment IV

- Impact Review Action Notice (no conclusions).

8.7.5 Attachment V

- CPS Structural Steel Supports Catalog (no conclusions).

8.7.6 Attachment VI

- Catalog cuts from jack manufacturer's catalog (no conclusions)
- Record of telephone conversation, definition of snug tight on bolts. Tension in bolt is negligible for snug tight condition.

8.7.7 Attachment VII

- Mill tolerances per AISC M016 and ASTM A6.
- Bending tolerances (see Attachment).
- Installation tolerances (see Attachment).
- Steel set is adequate to accommodate cumulative offset tolerances.

8.7.8 Attachment VIII

- W6 x 20 steel set is adequate for 17 ton jacking force (15 ton nominal) but not adequate for 20 ton jacking force.
- Jacking centerline to be maximum of 5 in. from W6 X-X axis.

8.7.9 Attachment IX

- Proposed design of steel sets components and accessories shall be as shown on the sketches of this attachment. However, Constructor may modify the following items (with A/E approval of shop drawings):

  - Steel set configuration (Pages IX-3, 4, 5, & 16)
  - Steel set joint locations (Pages IX-3 & 4)
  - Jacking brackets (Pages IX-3, 4, 5, 8, 13, 16, 17, 18, & 19)
  - Inserts (Page IX-4, IX-16)
  - Materials (Page IX-1)
  - Connections (Page IX-11 & 15)
  - Details (Pages IX-6, 9, 12, 14, 15 & 17)

8.7.10 Attachment X

- W8x31 baseplate is within the design limit stress (27 ksi, or 36 ksi with 1/3 allowable increase for seismic loading).

9. ATTACHMENTS

There are 10 attachments to this analysis.

ATTACHMENT	DESCRIPTION
I	Jacking Load Analysis
II	Rock Long-Term Load Computer Analysis Results
III	Steel Set Member and Components Design
IV	Impact Review Action Notice
V	CPS Structural Steel Supports Catalog
VI	Miscellaneous Reference Data
VII	Miscellaneous Shop Fabrication Tolerances and Steel Set Installation Tolerances
VIII	Structural Steel Set Using W6 x 20
IX	Summary of Design Sketches
X	Finite Element Analysis for W8x31 Baseplate

ATTACHMENT I

Jacking load analysis

TWO SIDED JACKING WITH VARIOUS SIZE JACKS APPLIED EQUALLY ON EACH SIDE

STLRV2 - Two sided jacking with 50 Ton, 30 Ton and 25 Ton jacking load applied at 47

TWO SIDED JACKING WITH 25 TON JACKING LOADS

STLRV3A - Jacking loads applied at 49°.

STLRV3D - Jacking loads applied at 51

STLRV3B - Jacking loads applied at 47° and member end moments released at splice locations.

STLRV3C - Jacking loads applied at 49° and member end moments released at the splice locations.

STLRV3A1 - Jacking loads applied at 47 with rock engagement at most joints (near the completion of the jacking process).

STLRV3A2 - Jacking loads applied at 47 with rock engagement at all joints (near the completion of the jacking process).

ONE SIDED JACKING WITH A 25 TON JACKING LOAD

STLRV4 - Jacking load applied at 47°.
STLRV4A - Jacking load applied at 49°.
STLRV4B - Jacking load applied at 51

STLRV4C - Jacking load applied at 47 , with member end moments released at the splice location.

ATTACHMENT I

PURPOSE AND DESCRIPTION

The purpose for the computer analyses in this attachment is to determine the jack size to be used for the W8X31 steel sets, and then evaluate the W8X31 shape for stresses from the jacking process using the selected jack capacity under different jack loading conditions and jacking settings.

Computer analysis STLRV2 for jack capacities of 50, 30 and 25 tons was executed. Based on this computer analysis and hand calculations in Attachment III pages III-25 through III-27, a maximum size jack of 27 Tons was selected for the jacking operation.

With the jacking force established, the location of jacking loads were varied to simulate the angle range that the jacking forces may be applied to the steel set during the jacking process. Computer analyses were performed with the jacking force applied at 47, 49 and 51 degrees. The 47 and 49 degrees correspond to two different jacks that can be used (see the jack information sheet in this attachment, which is based on the attachment VI tables), and the 51 degree is based on the possibility of using a crown segment based on an angle of 84 degrees arc length instead of the typical 90 degrees. The 51 degrees angle is also the angle that defines the jacking load position when no insert is used. Comparing the analyses: STLRV2, STLRV3A and STLRV3D for two side jacking, and the analyses: STLRV4, STLRV4A and STLRV4B for one side jacking, the conclusions are: (1). There is no difference between the stresses in the steel set caused by two side jacking and one side jacking (hence no further computer analyses for one side jacking are required), and (2). that the jacking at 47 degrees produces higher stresses in the steel set that the jacking force applied at 49 or 51 degrees, hence all the other analyses were performed with jacking force at 47 degrees. The difference between the stresses obtained from varying the angle is typically less than 2%, (4% overall), (see Summary of Computer Analyses for Jacking Loads for comparison). No other analyses were performed with jacking force application below 47 degrees because the small difference expected between the resulting stresses, if the jack was to be applied at a lower point.

In addition to the varying the angle of the jacking force application, computer analyses were performed to simulate the boundary conditions of the splice connections during the jacking process. Depending on when the bolts in the splice connection are tightened the connection may or may not be capable of transmitting moment across the splice during the jacking process. These two conditions were evaluated and the results from the various computer analyses revealed that if the bolts are not tightened, slightly higher stress levels are induced in the W8X31 steel set member when the splice connection acts as a pin connection (capable only of taking shear), versus the bolts being tightened and the connection being capable of transmitting moment through the splice prior to starting the jacking process. Note computer analyses STLRV2, 3A, and 4, versus the corresponding computer analyses STLRV3B, 3C and 4C.

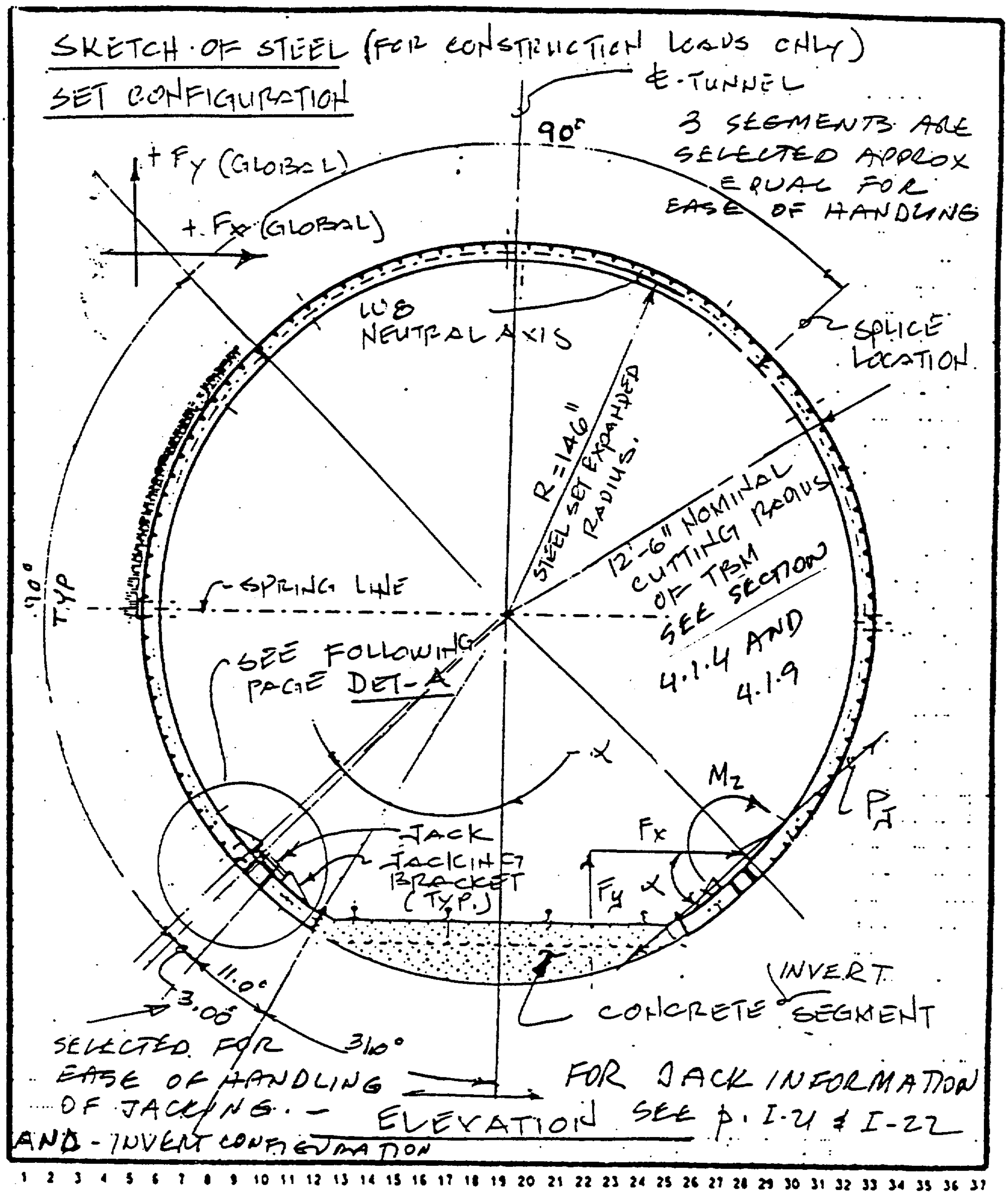
The initial contact\support points of the steel sets to the rock, is assumed to be at maximum 5 nodes which corresponds to approximately 6 ft. This is a conservative assumption, as compared to making positive contact with the rock in the tunnel crown and walls, as a result of 25 Ton jacking force. (See section 4.3.4)

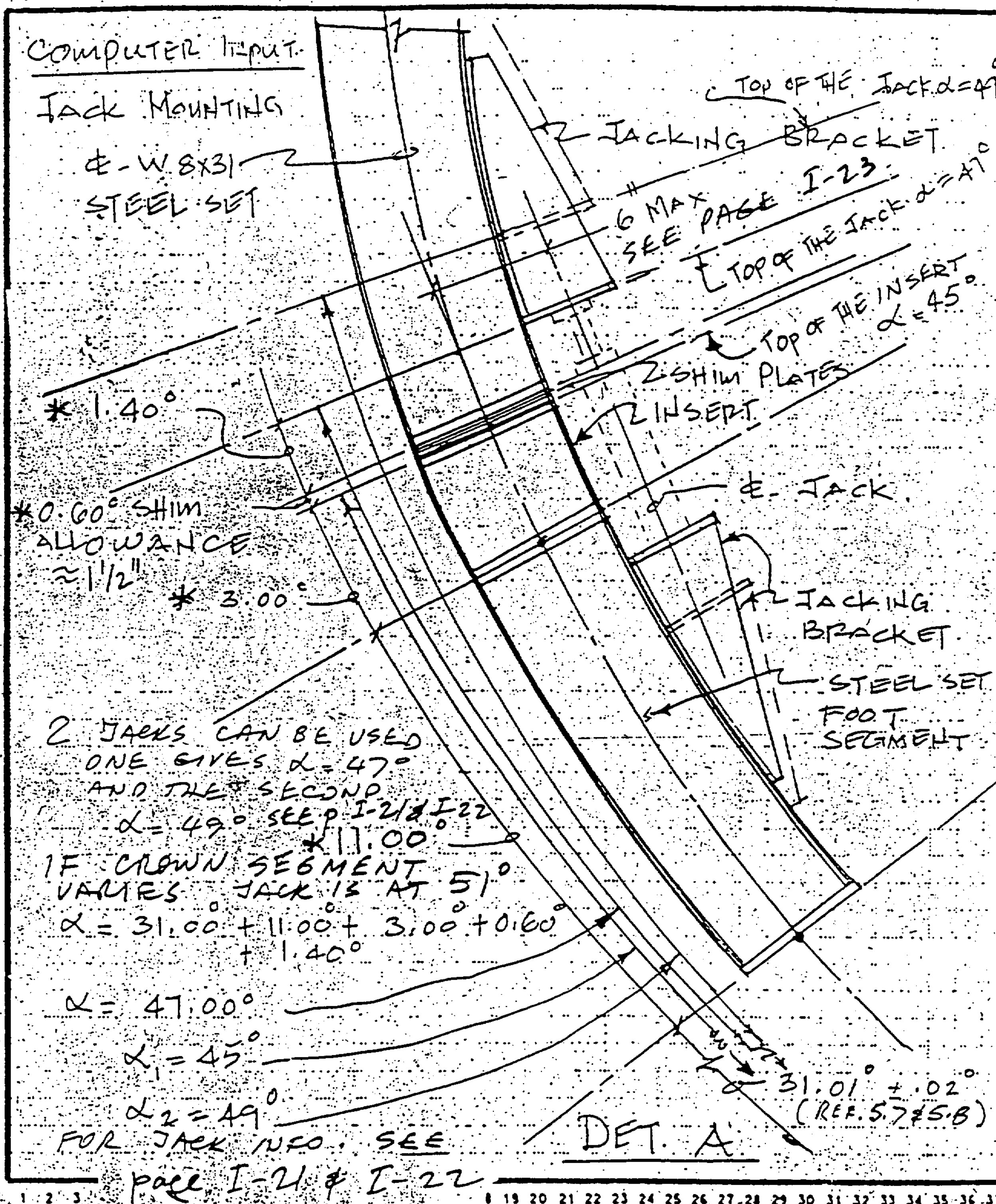
Additional computer analyses were performed to simulate the jacking process as the steel set restraint changes from initial contact/support points with the excavated profile (as described in the above paragraph) to partial, and then full engagement with the rock. See computer analyses STLRV3A1 and A2.

The transition from the initial horizontal contact points below the spring line at each 4 nodes to the full engagement of the steel set by the rock, will occur during the jacking process as the steel set moves upward into the excavated profile of the tunnel and additional supports are provided by the rock. As the steel set is brought in contact with more points of the excavated profile's walls and crown , additional horizontal and vertical supports between the steel sets and the rock will be engaged above the spring line, further restraining the movement of the steel set. No vertical supports are provided below the spring line due to the fact that the steel set is moving upward during the jacking operation and only supports above the spring line can restrain this vertical movement. (For supports layouts see page I-21 and individual computer inputs). In the final stage, additional intermediate points make contact, providing full or almost full support.

After the jacking process is completed, as described in the above paragraph, long term rock loads begin to act on the steel set . This condition is analyzed in attachment II of this analysis.

Hand calculations are performed in Attachment III based on the maximum member forces from this attachment and Attachment II.


SKETCH OF STEEL (FOR CONSTRUCTION LOADS ONLY)
SET CONFIGURATION
℄-TUNNEL
90°
3 SEGMENTS ARE SELECTED APPROX EQUAL FOR EASE OF HANDLING
+Fy (GLOBAL)
+Fx (GLOBAL)
W8 NEUTRAL AXIS
SPLICE LOCATION
R=146" STEEL SET EXPANDED RADIUS.
12'-6" NOMINAL CUTTING RADIUS OF TBM SEE SECTION 4.1.4 AND 4.1.9
90° TYP
SPRING LINE
SEE FOLLOWING PAGE DET-A
α
Mz
PH
Fx
Fy
JACK
JACKING BRACKET (TYP.)
11.0°
3.00
INVERT CONCRETE SEGMENT
SELECTED FOR EASE OF HANDLING OF JACKING. -
316°
FOR JACK INFORMATION SEE p. I-21 & I-22
ELEVATION
AND - INVERT CONFIGURATION



FOR PARAMETERS MARKED *
SEE SECTION 4.1.4 FOR DISCUSSION

COMPUTER INPUT

FOR THE COMPUTER MODEL OF THE STEEL SET USE 8 EQUAL LENGTH MEMBERS FROM THE CONCRETE INVERT TO THE SPRING LINE. THIS RELATES TO A MEMBER LENGTH OF 18.79 INCHES (SEE BELOW).

ARC LENGTH OF THE SEGMENT BEAM FROM THE SPRING LINE TO THE CONCRETE INVERT EQUALS:

$$\text{ARC LENGTH} = \frac{\pi r A}{180} = \frac{3.14(146)(90^\circ - 31^\circ)}{180^\circ}$$

$$= 150.34 \text{ INCHES}$$

$$\text{MEMBER LENGTH} = \frac{150.34}{8} = 18.79 \text{ INCHES}$$

FOR THE COMPUTER MODEL USE 14 MEMBERS FROM THE SPRING LINE TO THE CROWN OF THE STEEL SET. THIS RELATES TO A MEMBER LENGTH OF 16.38 INCHES (SEE BELOW)

ARC LENGTH OF THE SEGMENT FROM THE SPRING LINE TO THE CROWN EQUALS,

$\text{ARC LENGTH} = \pi r A^\circ / 180 = 229.34 \text{ INCHES}$

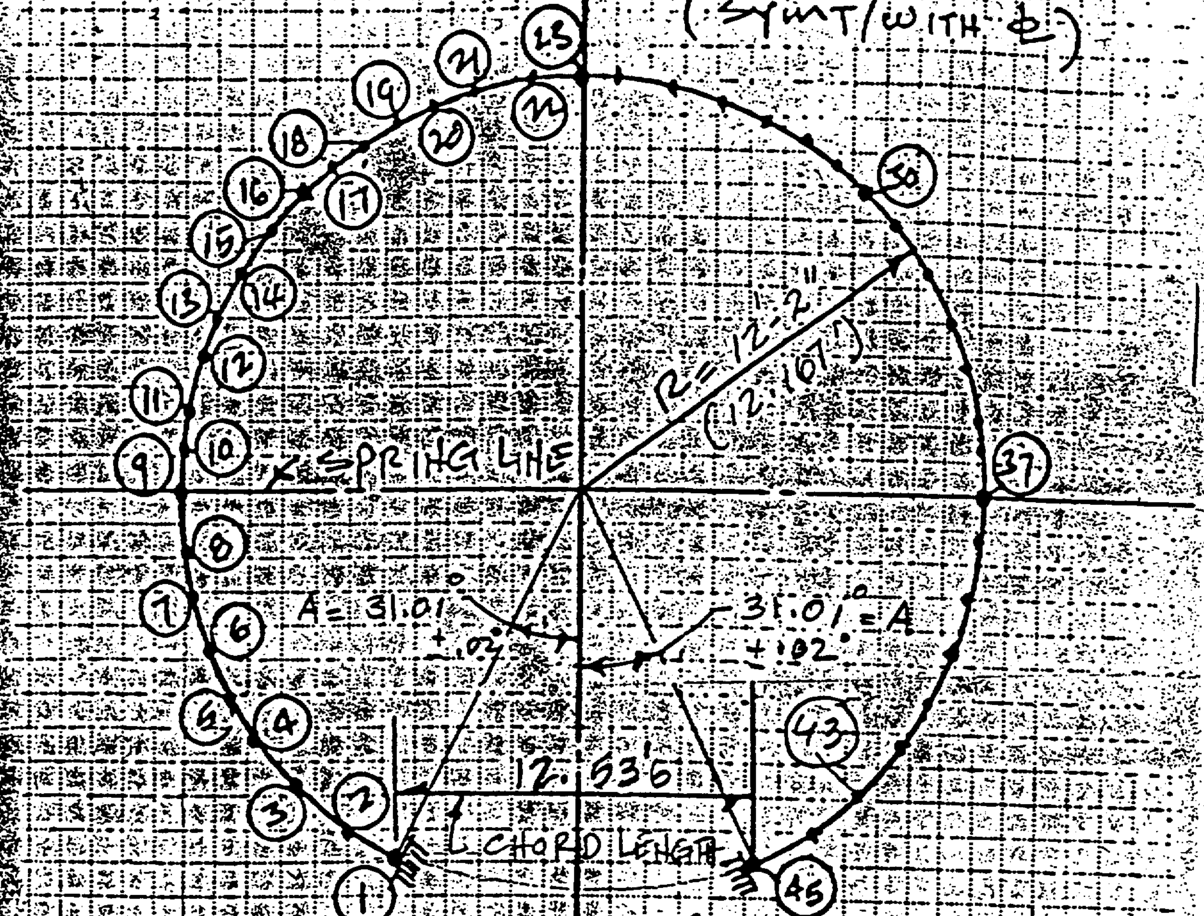
$\text{MEMBER LENGTH} = 229.34/14 = 16.38 \text{ INCHES}$

THIS WILL PROVIDE A REASONABLE COMPUTER MODEL MEMBER LENGTH FOR A STRUCTURAL ANALYSIS OF THE STEEL SET.

COMPUTER INPUT (FOR CONSTRUCTION AND ROCK LONG TERM LOADS)

(NO) - NODE NUMBER

℄ - TBM TUNNEL (SYMT/WITH ℄)



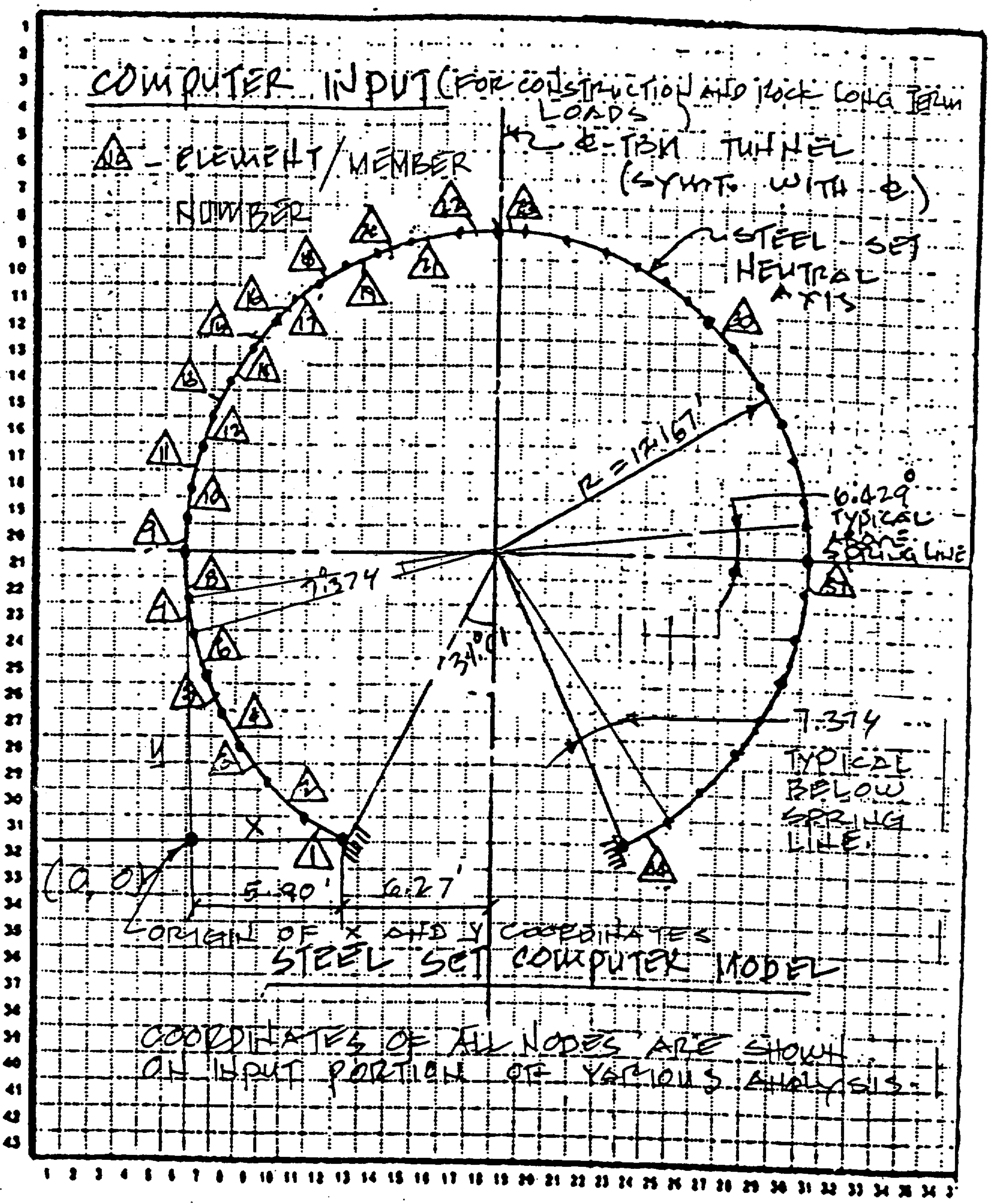
CHORD LENGTH = 2(R) SIN A° , A° = 31.01 ± .02°
PER REF. 5.7 & 5.8

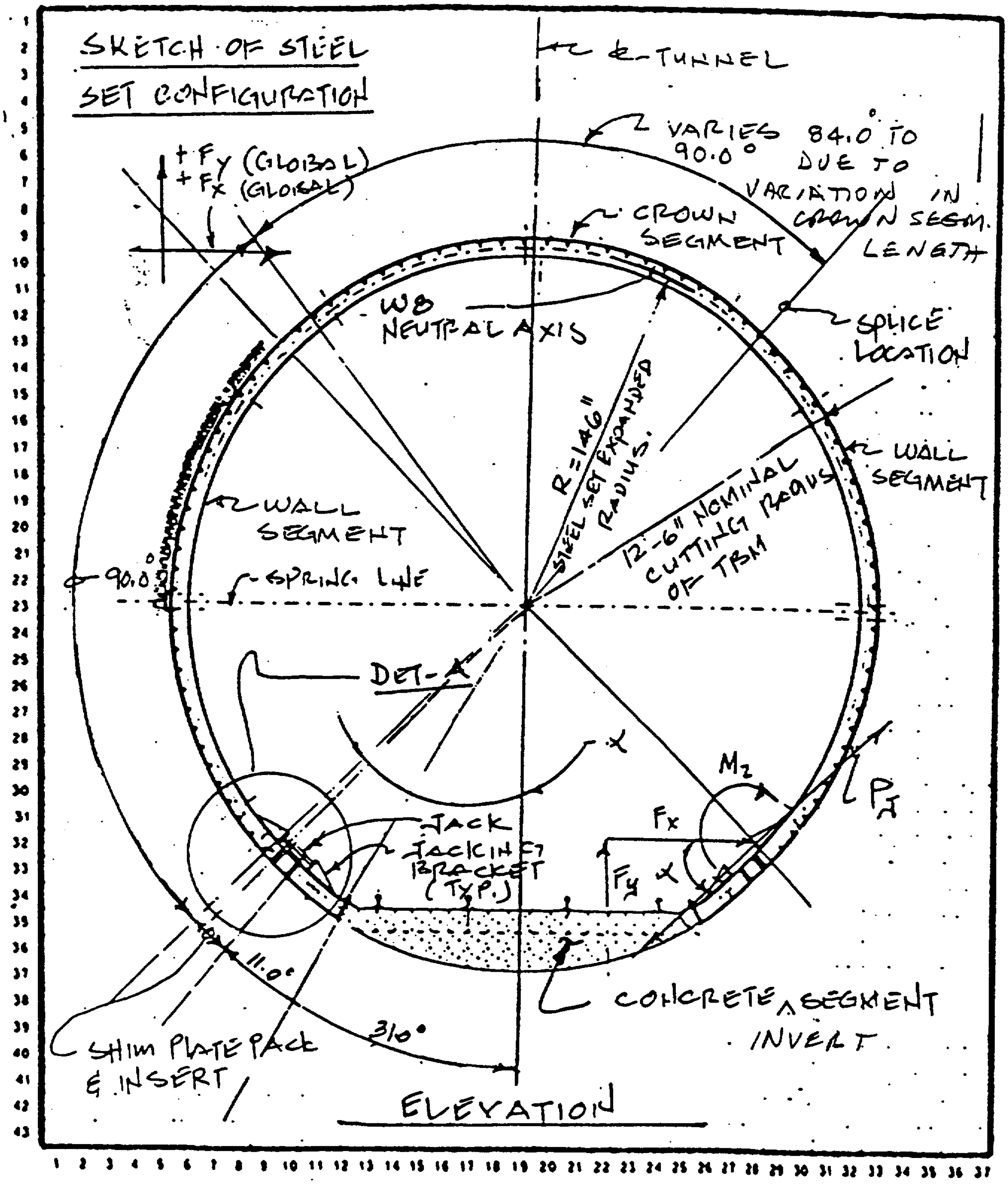
CHORD LENGTH = 2(12.167) SIN 31.0°

STEEL SET COMPUTER MODEL

CHORD LENGTH = 12.536 FT

COORDINATES OF ALL NODE ARE GENERATED FROM THIS MODEL.


COMPUTER INPUT (FOR CONSTRUCTION AND ROCK LONG TERM LOADS)
- ELEMENT/MEMBER NUMBER
℄-TBM TUNNEL (SYMT. WITH ℄)
STEEL SET NEUTRAL AXIS
R = 12.167'
6.429°
TYPICAL
7.374
34.01°
7.374
TYPICAL BELOW SPRING LINE
Y
X
(0, 0)
5.90'
6.27'
ORIGIN OF X AND Y COORDINATES
STEEL SET COMPUTER MODEL
COORDINATES OF ALL NODES ARE SHOWN ON INPUT PORTION OF VARIOUS ANALYSIS.


SKETCH OF STEEL SET CONFIGURATION
℄-TUNNEL
VARIES 84.0° TO 90.0° DUE TO VARIATION IN CROWN SEGM. LENGTH
+Fy (GLOBAL)
+Fx (GLOBAL)
CROWN SEGMENT
W8 NEUTRAL AXIS
SPLICE LOCATION
WALL SEGMENT
R=146" STEEL SET EXPANDED RADIUS.
12'-6" NOMINAL CUTTING RADIUS OF TBM
WALL SEGMENT
90.0°
SPRING LINE
DET-A
α
M2
Fx
Fy
α
JACK
JACKING BRACKET (TYP.)
11.0°
310°
CONCRETE SEGMENT INVERT
SHIM PLATE PACK & INSERT
ELEVATION

JACKING FORCE

LOCATION. PJ ALSO = 50°, 30°

P_J = JACKING FORCE

$P_J = 25^T$ & 20^T

STEEL SET 2
WALL SEGMENT

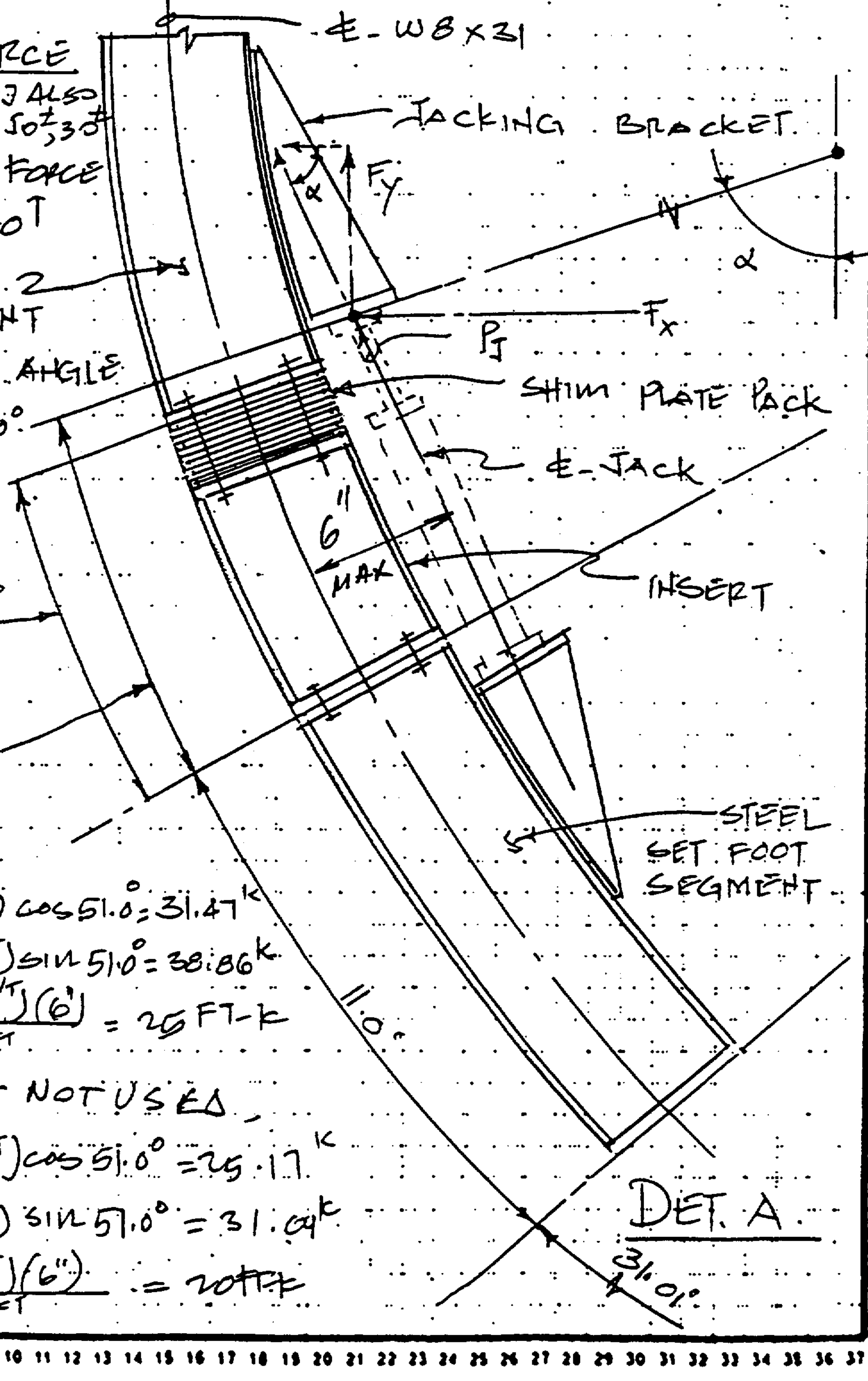
α = JACKING ANGLE

$\alpha = 31.0° + 11.0° + 9.0°$

$\alpha = 51.0°$ (MAX.)

VARIES 3.60° TO 6.0°

VARIES 5.0° TO 9.0°



IF $P_J = 25^T$

$F_X = 25^T (2^{k/T}) \cos 51.0° = 31.47^k$

$F_Y = 25^T (2^{k/T}) \sin 51.0° = 38.86^k$

$M_J = \frac{25^T (2^{k/T})(6")}{12"/FT} = 25$ FT-K

(IF $P_J = 20^T$) - NOT USED

$F_X = 20^T (2^{k/T}) \cos 51.0° = 25.17^k$

$F_Y = 20^T (2^{k/T}) \sin 51.0° = 31.09^k$

$M_J = \frac{20^T (2^{k/T})(6")}{12"/FT} = 20$ FT-K

COMPUTER INPUT } THE X AND Y COORDINATES ARE GENERATED FROM THE INFORMATION PRESENTED ON THE MODELS

UNIT FT

JOINT COORDINATES

	X	Y		X	Y
1	5.90	0.00	16	3.56	19.03
2	4.61	0.89	17	4.58	19.94
3	3.45	1.94	18	5.69	20.73
4	2.43	3.13	19	6.89	21.39
5	1.58	4.44	20	8.15	21.91
6	0.90	5.85	21	9.46	22.29
7	0.40	7.33	22	10.80	22.52
8	0.10	8.87	23	12.17	22.60
9	0.00	10.43	24	13.53	22.52
10	0.08	11.79	25	14.87	22.29
11	0.31	13.14	26	16.18	21.91
12	0.68	14.45	27	17.45	21.39
13	1.21	15.71	28	18.64	20.73
14	1.86	16.90	29	19.75	19.94
15	2.65	18.02	30	20.77	19.03

COMPUTER INPUT

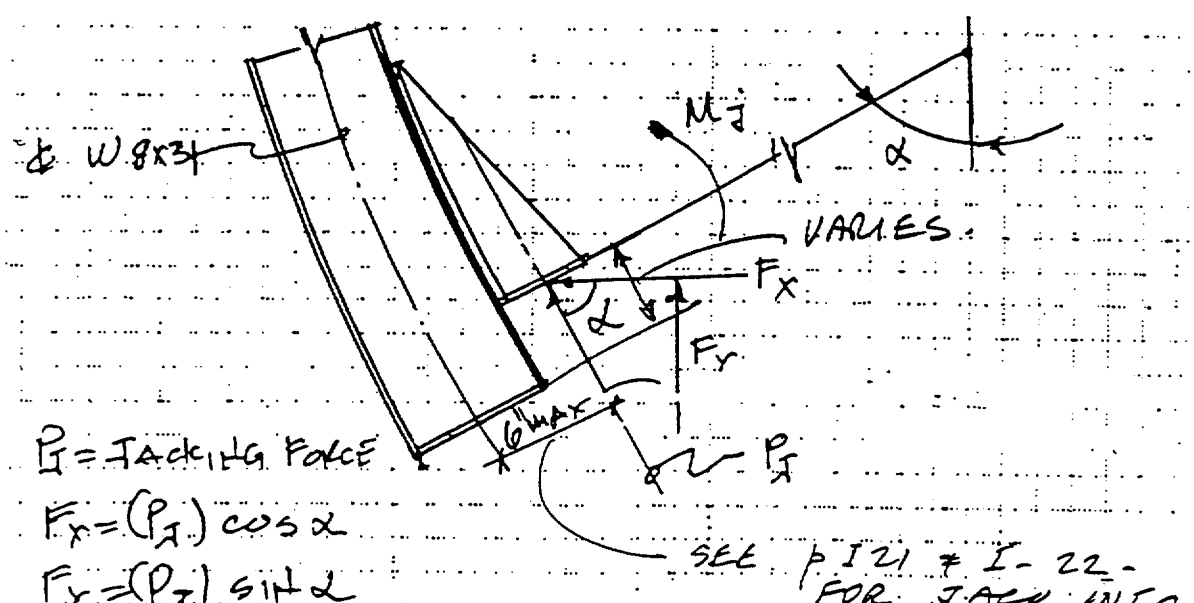
JOINT COORDINATES

	X	Y
31	21.68	18.02
32	22.47	16.90
33	23.13	15.71
34	23.65	14.45
35	24.03	13.14
36	24.26	11.79
37	24.33	10.43
38	24.23	8.87
39	23.93	7.33
40	23.44	5.86
41	22.76	4.44
42	21.90	3.13
43	20.88	1.94
44	19.72	0.89
45	18.43	0.00

COMPUTER INPUT

CONSTRUCTION LOAD - JACKING PROCESS WITH VARIOUS JACKING CAPACITY

ANALYSE W8x31 FOR JACKING.



P_J = JACKING FORCE

$F_X = (P_J) \cos \alpha$

$F_Y = (P_J) \sin \alpha$

M_J = JACKING MOMENT = P_J (6")

COMPUTER INPUT (FOR JACKING LOADS ONLY)
50 TONS, 30 TONS AND 25 TONS SIMULTANEOUS JACKING

FOR: $\alpha = 47.00°$

$F_y = P_J \sin\alpha$, M_J = MOMENT FROM JACKING FORCE.

$F_x = P_J \cos\alpha$

CONVERT TON TO KIP 1 TON = 2 KIP

FOR 50 TONS JACK $M_J = \frac{50^T (2)^{K/T} (6)}{12^{"/1}} = 50.0^{FT-K}$

FOR 30 TONS JACK $M_J = \frac{30^T (2)^{K/T} (6)}{12^{"/1}} = 30.0^{FT-K}$

FOR 25 TONS JACK $M_J = \frac{25^T (2)^{K/T} (6)}{12^{"/1}} = 25.0^{FT-K}$

50 TONS JACK

$F_y = 50 (2) \sin 47.00° = 73.14^K$

$F_x = 50 (2) \cos 47.00° = 68.20^K$

30 TONS JACK

$F_y = 30 (2) \sin 47.00° = 43.88^K$

$F_x = 30 (2) \cos 47.00° = 40.92^K$

25 TONS JACK

$F_y = 25 (2) \sin 47.00° = 36.57^K$

$F_x = 25 (2) \cos 47.00° = 34.10^K$

COMPUTER INPUT FOR $\alpha = 49°$

$\alpha = 49.00°$

$F_Y = P_I \sin \alpha$

$P_X = P_I \cos \alpha$

50 TONS JACK

$F_Y = 50(2) \sin 49.00° = 75.47^k$

$F_X = 50(2) \cos 49.00° = 65.61^k$

30 TONS JACK

$F_Y = 30(2) \sin 49.00° = 45.28^k$

$F_X = 30(2) \cos 49.00° = 39.36^k$

25 TONS JACK

$F_Y = 25(2) \sin 49.00° = 37.74^k$

$F_X = 25(2) \cos 49.00° = 32.80$

20 TONS JACK : NOT USED

$M_I = \frac{20^T (2)^{k/T} (6)}{12 \ ''/'} = 20$ FT-k

$F_Y = 20(2) \sin 49.00° = 30.19^k$

$F_X = 20(2) \cos 49.00° = 26.24^k$

FOR COMPUTER INPUT MEMBER SELFWEIGHT WILL BE INCREASED BY 2.5 TO ACCOUNT FOR LAGGING - SEE NEXT PAGE

CALCULATE LAGGING WEIGHT TRIBUTARY TO STEEL SET ~

STEEL SET SPACING = 4'-0" ±

			SPACING	
C 8 x 11.5	= 11.5 PLF x 4	= 46 lb	x 12"/8"	= 69.0
$1\frac{1}{2}$" Φ PIPE SPACER	= 2.7 PLF x 4	= 10.8 lb	x 1/7.43'	= 1.45
TIE ROD ($\frac{3}{4}$" Φ)	= 1.5 PLF x 4	= 6.0 lb	x 1/7.43	= 0.81
	TOTAL WT	= 71.3 lb		71.3

$$\frac{\text{TOTAL WT.}}{\text{STEEL SET DEAD LOAD}} = \frac{71.3}{31} = 2.3$$

(USE OF FACTOR 2.5 IN COMPUTER INPUT FOR SELFWEIGHT)

- FOR LAGGING THERE IS NO SPACING

- FOR TIE ROD SPACING SEE PAGE IX - 6

COMPUTER INPUT FOR $\alpha = 51°$.

$F_y = 25\,(2) \sin 51° = 38.86^{k}$

$F_x = 25\,(2) \cos 51° = 31.47^{k}$

DETERMINE POINT OF APPLICATION OF JACKING LOAD FOR ANGLES OF APPLICATION AT 47°, 49° AND 51°

THE POINT OF APPLICATION WILL ALWAYS BE AT POINTS: 3 OR 43 as applicable SO: WE WILL VARY THE COORDINATES OF JTS. 3 & 43 FOR DIFFERENT ANGLES OF APPLICATION -

47°: $X = -\sin 47° * 146'' + 146'' = 39.2236''$

$= -106.77764 + 146 = 3.27'$ SEE PI-20

$Y = -\cos 47° * 146'' + 146'' - 20.8667'' =$

$= -99.57176'' + 146'' - 20.8667'' = 2.13'$

POINT 3 $\left\langle \begin{array}{l} X = 3.27' \\ Y = 2.13' \end{array} \right.$

POINT 43 $\left\langle \begin{array}{l} X = \sin 47° * 146'' + 146'' = 21.06' \\ Y = 2.13' \end{array} \right.$

$49°$ $X = -\sin 49° * 146'' + 146'' = 35.8126''$

$= 2.98'$

$Y = -\cos 49° * 146'' * 146'' - 20.8667''$ (.656)

$= 29.3487'' = 2.45'$

JT 3: $X = 2.98'$, $Y = 2.45'$

JT 43: $X = \sin 49° * 146'' + 146'' = 21.35$, $Y = 2.45'$

$51°$ - JT 3: $X = -\sin 51° * 146'' + 146'' = 2.71'$

$Y = -\cos 51' * 146 + 146 - 20.8667 = 2.77$ (SEE NEXT PAGE)

JT 43: $X = \sin 57° * 146 + 146 = 113.46 + 146$

$= 259.46'' = 21.62'$

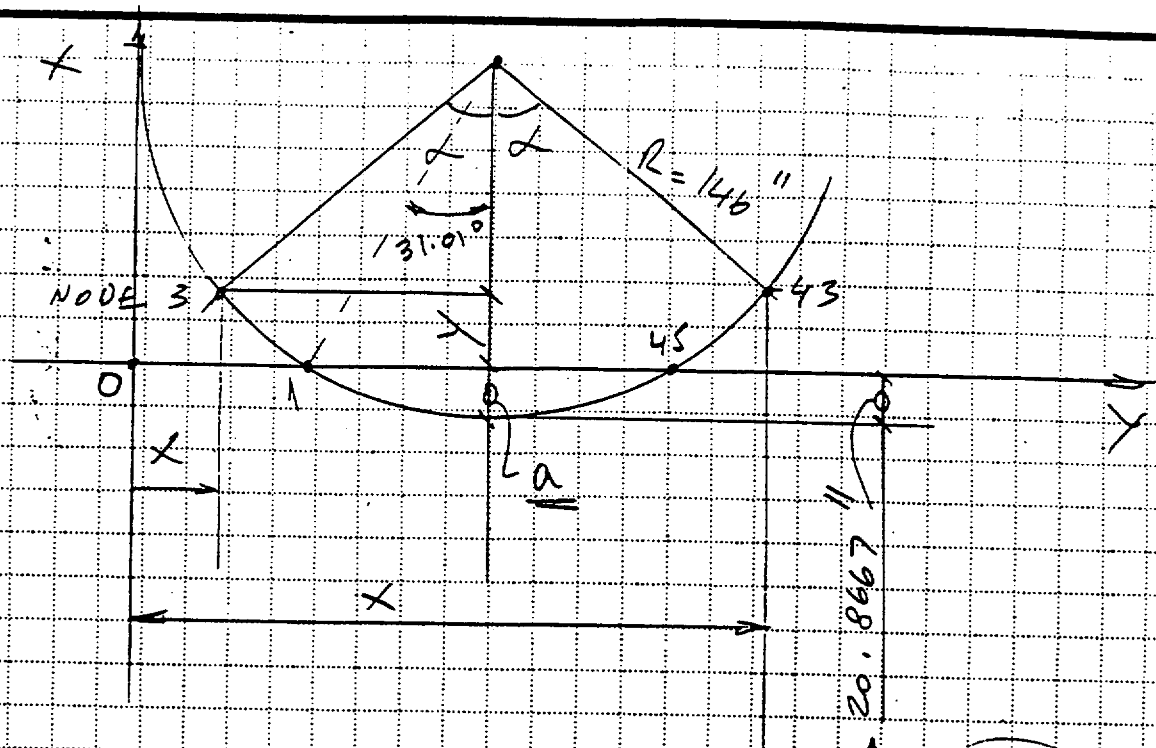
$Y = 2.77$

$X = 21.62$, $Y = 2.77$ "FOR JACKS APPLIED ON BOTH SIDES"

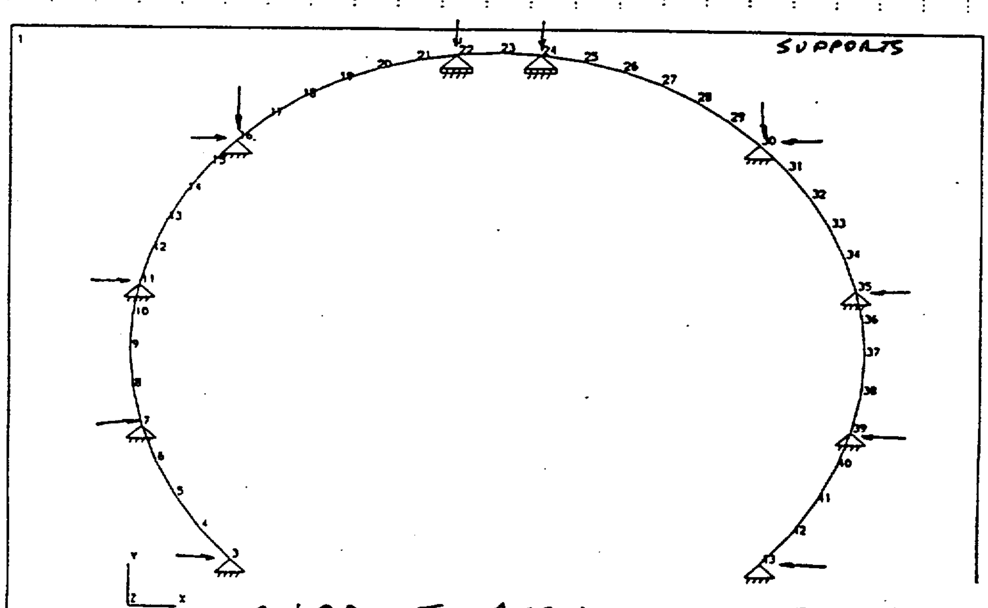
FOR JACK APPLIED ON ONE SIDE - AT JT 3 COORDINATES FOR JT's 43, 44, 45 NEED NOT CHANGE

ALL ANGLES ARE MEASURED FROM THE VERTICAL AXIS TOWARDS THE NODE

SEE NEXT PAGE



$a = 146'' - \cos 31.01 * 146'' = 20.8667''$



SUPPORT ASSUMPTION FOR NORMAL JACKING

DETERMINE JACK CHARACTERISTICS FOR COMPUTER INPUT - ATTACHMENT VI pg VI-3

FROM DISCUSSIONS WITH CONTRACTOR, JACKS HSR 258T and HSR 2510T ARE CHOSEN AS A CLOSE REPRESENTATION OF THE JACKS THAT WOULD ACTUALLY BE PROCURED AND USED. APPROXIMATE DIMENSIONS:

JACK.	CLOSED HEIGHT	+	STROKE	=	TOTAL
HSR-258T	12"	+	8"	=	20"
HSR-2510T	14"	+	10"	=	24"

FOR BOTH JACKS THE BODY DIAMETER IS 3"

ESTABLISH JACK POSITION

FIRST POSITION IS AT 47° WITH VERTICAL AXIS IF HSR-258T IS USED — SEE pg I-7. - FOR CALCULATION.

IF HSR-2510T IS USED.

THERE IS A MAXIMUM DIFFERENCE OF

$$24'' - 20'' = 4''$$

FOR 1° THE ARC LENGTH $= \frac{2\pi \times 146''}{360°} = 2.55''$

AT ℄ OF STEEL SET

$$4'' \div 2.55''/\text{DEGREE} = 1.57° = 2°$$

HENCE CONSIDER THE SECOND POSITION AT 49°

IN CASE THE CROWN SEGMENT (ation) IS VARRIED FROM 90° TO 84°

$90° - 84° = 6°$ - variation

$6° \div 2 = 3°$ on each side

$47° + 3° = 50°$

$49° + 3° = 52°$

CHECK ADEQUACY OF STEEL SET FOR 51° - WHICH WILL GIVE CLOSE RESULTS FOR BOTH CASES.

DISTANCE BETWEEN ℄ STEEL SET AND ℄ JACK.

JACK BODY = 3". SEE ATTACHMENT VI. page VI-3 -

$3" \div 2 = 1\frac{1}{2}"$

ADD : $4"$ (½ W8×31) + $1\frac{1}{2}" = 5\frac{1}{2}"$

SEE ATTACHMENT IX page IX-8.

HENCE KEEP JACK AT MAX 6"

℄ STEEL SET TO ℄ JACK - (½" TOLERANCE)

```
*****************************************************
*                                                   *
*              S T A A D - III                      *
*              Revision 16.0b                       *
*              Proprietary Program of               *
*              RESEARCH ENGINEERS, Inc.             *
*              Date=     JUL 17, 1995               *
*              Time=     16:12:22                   *
*                                                   *
*****************************************************

  2. STAAD PLANE BABEE0000-01717-0200-00003  ATTACHMENT  I
  3. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
  4. * 50 T, 30 T AND 25 T JACKING LOADS APPLIED TO BOTH SIDES OF STEEL SET
  5. * AT 47 DEGREES.        FILE STLRV2
  6. UNIT FT KIP
  7. JOINT COORDINATES
  8. 3 3.27 2.13 ; 4 2.43 3.13
  9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
 10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
 11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
 12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
 13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
 14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
 15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
 16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
 17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
 18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.06 2.13
 19. MEMBER INCIDENCE
 20. 3 3 4 42
 21. UNIT KIP INCH
 22. MEMBER PROPERTIES
 23. 3 TO 42 TA STA W8X31
 24. CONSTANTS
 25. E 29000.0 ALL
 26. DENSITY 0.00028 ALL
 27. BETA 0 ALL
 28. UNIT FT
 29. SUPPORT
 30. 3 7 11 35 39 43 FIXED BUT FY MZ
 31. 22 24 FIXED BUT FX MZ
 32. 16 30 PINNED
 33. UNIT KIP
 34. LOAD 1
 35. SELF WEIGHT Y -1.0
 36. LOADING 2
 37. * 50 TON JACKS AT EACH SIDE
 38. JOINT LOADING
 39. 3 FY 73.14
 40. 43 FY 73.14
 41. 3 FX -68.20
 42. 43 FX 68.20
 43. 43 MZ -50.00
 44. 3 MZ 50.00
 45. LOADING 3
 45. * 30 TON JACKS AT EACH SIDE
 46. JOINT LOADING
 47. 3 FY 43.88
```

```
48. 43 FY 43.88
49. 3 FX -40.92
50. 43 FX 40.92
51. 43 MZ -30.00
52. 3 MZ 30.00
53. LOADING 4
54. * 25 TON JACKS AT EACH SIDE
55. JOINT LOADING
56. 3 FX -34.10
57. 43 FX 34.10
58. 3 FY 36.57
59. 43 FY 36.57
60. 43 MZ -25.00
61. 3 MZ 25.00
62. LOADING COMBINATION 5
63. 1 2.5 2 1.0
64. LOADING COMBINATION 6
65. 1 2.5 3 1.0
66. LOADING COMBINATION 7
67. 1 2.5 4 1.0
68. PERFORM ANALYSIS


       P R O B L E M   S T A T I S T I C S
       -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     41/    40/    10
  ORIGINAL/FINAL BAND-WIDTH =      1/     1
  TOTAL PRIMARY LOAD CASES  =      4, TOTAL DEGREES OF FREEDOM =    111
  SIZE OF STIFFNESS MATRIX =       666 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =      0.08 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.                 15:55:54
++ PROCESSING GLOBAL STIFFNESS MATRIX.                  15:55:55
++ PROCESSING TRIANGULAR FACTORIZATION.                 15:55:55
++ CALCULATING JOINT DISPLACEMENTS.                     15:55:55
++ CALCULATING MEMBER  FORCES.                          15:55:56

69. LOAD LIST 5 6 7
70. PRINT ANALYSIS RESULTS
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JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	5	0.00000	0.13013	0.00000	0.00000	0.00000	0.00680
	6	0.00000	0.07763	0.00000	0.00000	0.00000	0.00409
	7	0.00000	0.06451	0.00000	0.00000	0.00000	0.00341
4	5	-0.06137	0.07148	0.00000	0.00000	0.00000	0.00369
	6	-0.03686	0.04241	0.00000	0.00000	0.00000	0.00222
	7	-0.03074	0.03515	0.00000	0.00000	0.00000	0.00185
5	5	-0.08369	0.04927	0.00000	0.00000	0.00000	0.00015
	6	-0.05027	0.02908	0.00000	0.00000	0.00000	0.00009
	7	-0.04192	0.02404	0.00000	0.00000	0.00000	0.00008
6	5	-0.05310	0.05695	0.00000	0.00000	0.00000	-0.00198
	6	-0.03189	0.03371	0.00000	0.00000	0.00000	-0.00119
	7	-0.02660	0.02790	0.00000	0.00000	0.00000	-0.00099
7	5	0.00000	0.06840	0.00000	0.00000	0.00000	-0.00145
	6	0.00000	0.04060	0.00000	0.00000	0.00000	-0.00087
	7	0.00000	0.03366	0.00000	0.00000	0.00000	-0.00073
8	5	0.00462	0.06415	0.00000	0.00000	0.00000	-0.00012
	6	0.00281	0.03808	0.00000	0.00000	0.00000	-0.00007
	7	0.00235	0.03156	0.00000	0.00000	0.00000	-0.00006
9	5	0.00113	0.05880	0.00000	0.00000	0.00000	0.00008
	6	0.00071	0.03488	0.00000	0.00000	0.00000	0.00005
	7	0.00060	0.02891	0.00000	0.00000	0.00000	0.00004
10	5	0.00120	0.05432	0.00000	0.00000	0.00000	0.00012
	6	0.00072	0.03221	0.00000	0.00000	0.00000	0.00007
	7	0.00060	0.02669	0.00000	0.00000	0.00000	0.00006
11	5	0.00000	0.05003	0.00000	0.00000	0.00000	0.00077
	6	0.00000	0.02966	0.00000	0.00000	0.00000	0.00046
	7	0.00000	0.02457	0.00000	0.00000	0.00000	0.00038
12	5	-0.02698	0.05250	0.00000	0.00000	0.00000	0.00111
	6	-0.01598	0.03112	0.00000	0.00000	0.00000	0.00065
	7	-0.01323	0.02577	0.00000	0.00000	0.00000	0.00054
13	5	-0.04444	0.05435	0.00000	0.00000	0.00000	0.00030
	6	-0.02631	0.03220	0.00000	0.00000	0.00000	0.00018
	7	-0.02178	0.02666	0.00000	0.00000	0.00000	0.00015
14	5	-0.04286	0.04773	0.00000	0.00000	0.00000	-0.00088
	6	-0.02538	0.02827	0.00000	0.00000	0.00000	-0.00052
	7	-0.02101	0.02341	0.00000	0.00000	0.00000	-0.00043
15	5	-0.02384	0.02810	0.00000	0.00000	0.00000	-0.00171
	6	-0.01412	0.01665	0.00000	0.00000	0.00000	-0.00101
	7	-0.01169	0.01378	0.00000	0.00000	0.00000	-0.00084
16	5	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00139
	6	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00082
	7	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00068
17	5	0.00772	-0.00961	0.00000	0.00000	0.00000	-0.00050
	6	0.00461	-0.00576	0.00000	0.00000	0.00000	-0.00030
	7	0.00383	-0.00480	0.00000	0.00000	0.00000	-0.00025
18	5	0.00809	-0.01129	0.00000	0.00000	0.00000	0.00000
	6	0.00486	-0.00682	0.00000	0.00000	0.00000	0.00000
	7	0.00406	-0.00571	0.00000	0.00000	0.00000	0.00000

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
19	5	0.00578	-0.00852	0.00000	0.00000	0.00000	0.00021
	6	0.00351	-0.00522	0.00000	0.00000	0.00000	0.00013
	7	0.00294	-0.00440	0.00000	0.00000	0.00000	0.00010
20	5	0.00335	-0.00447	0.00000	0.00000	0.00000	0.00023
	6	0.00205	-0.00281	0.00000	0.00000	0.00000	0.00014
	7	0.00172	-0.00240	0.00000	0.00000	0.00000	0.00012
21	5	0.00170	-0.00134	0.00000	0.00000	0.00000	0.00015
	6	0.00104	-0.00088	0.00000	0.00000	0.00000	0.00009
	7	0.00088	-0.00077	0.00000	0.00000	0.00000	0.00008
22	5	0.00076	0.00000	0.00000	0.00000	0.00000	0.00008
	6	0.00046	0.00000	0.00000	0.00000	0.00000	0.00005
	7	0.00039	0.00000	0.00000	0.00000	0.00000	0.00004
23	5	0.00001	0.00094	0.00000	0.00000	0.00000	0.00000
	6	0.00001	0.00058	0.00000	0.00000	0.00000	0.00000
	7	0.00000	0.00048	0.00000	0.00000	0.00000	0.00000
24	5	-0.00074	0.00000	0.00000	0.00000	0.00000	-0.00008
	6	-0.00045	0.00000	0.00000	0.00000	0.00000	-0.00005
	7	-0.00037	0.00000	0.00000	0.00000	0.00000	-0.00004
25	5	-0.00168	-0.00132	0.00000	0.00000	0.00000	-0.00015
	6	-0.00103	-0.00088	0.00000	0.00000	0.00000	-0.00009
	7	-0.00087	-0.00076	0.00000	0.00000	0.00000	-0.00008
26	5	-0.00332	-0.00444	0.00000	0.00000	0.00000	-0.00023
	6	-0.00203	-0.00279	0.00000	0.00000	0.00000	-0.00014
	7	-0.00171	-0.00238	0.00000	0.00000	0.00000	-0.00012
27	5	-0.00574	-0.00848	0.00000	0.00000	0.00000	-0.00021
	6	-0.00348	-0.00520	0.00000	0.00000	0.00000	-0.00013
	7	-0.00292	-0.00438	0.00000	0.00000	0.00000	-0.00010
28	5	-0.00805	-0.01124	0.00000	0.00000	0.00000	0.00000
	6	-0.00484	-0.00680	0.00000	0.00000	0.00000	0.00000
	7	-0.00404	-0.00568	0.00000	0.00000	0.00000	0.00000
29	5	-0.00770	-0.00959	0.00000	0.00000	0.00000	0.00050
	6	-0.00460	-0.00575	0.00000	0.00000	0.00000	0.00030
	7	-0.00382	-0.00479	0.00000	0.00000	0.00000	0.00025
30	5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00138
	6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00082
	7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00068
31	5	0.02379	0.02807	0.00000	0.00000	0.00000	0.00171
	6	0.01409	0.01662	0.00000	0.00000	0.00000	0.00101
	7	0.01167	0.01377	0.00000	0.00000	0.00000	0.00084
32	5	0.04283	0.04770	0.00000	0.00000	0.00000	0.00089
	6	0.02536	0.02825	0.00000	0.00000	0.00000	0.00053
	7	0.02099	0.02339	0.00000	0.00000	0.00000	0.00044
33	5	0.04463	0.05450	0.00000	0.00000	0.00000	-0.00030
	6	0.02642	0.03229	0.00000	0.00000	0.00000	-0.00018
	7	0.02188	0.02674	0.00000	0.00000	0.00000	-0.00015
34	5	0.02678	0.05260	0.00000	0.00000	0.00000	-0.00111
	6	0.01586	0.03117	0.00000	0.00000	0.00000	-0.00066
	7	0.01313	0.02582	0.00000	0.00000	0.00000	-0.00054

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
35	5	0.00000	0.05001	0.00000	0.00000	0.00000	-0.00077
	6	0.00000	0.02965	0.00000	0.00000	0.00000	-0.00046
	7	0.00000	0.02456	0.00000	0.00000	0.00000	-0.00038
36	5	-0.00130	0.05429	0.00000	0.00000	0.00000	-0.00014
	6	-0.00078	0.03219	0.00000	0.00000	0.00000	-0.00008
	7	-0.00065	0.02668	0.00000	0.00000	0.00000	-0.00007
37	5	-0.00170	0.05874	0.00000	0.00000	0.00000	-0.00009
	6	-0.00105	0.03484	0.00000	0.00000	0.00000	-0.00006
	7	-0.00089	0.02888	0.00000	0.00000	0.00000	-0.00005
38	5	-0.00513	0.06409	0.00000	0.00000	0.00000	0.00013
	6	-0.00311	0.03804	0.00000	0.00000	0.00000	0.00008
	7	-0.00261	0.03153	0.00000	0.00000	0.00000	0.00007
39	5	0.00000	0.06824	0.00000	0.00000	0.00000	0.00149
	6	0.00000	0.04051	0.00000	0.00000	0.00000	0.00090
	7	0.00000	0.03358	0.00000	0.00000	0.00000	0.00075
40	5	0.05403	0.05680	0.00000	0.00000	0.00000	0.00201
	6	0.03245	0.03362	0.00000	0.00000	0.00000	0.00121
	7	0.02706	0.02783	0.00000	0.00000	0.00000	0.00101
41	5	0.08481	0.04903	0.00000	0.00000	0.00000	-0.00016
	6	0.05094	0.02894	0.00000	0.00000	0.00000	-0.00010
	7	0.04247	0.02392	0.00000	0.00000	0.00000	-0.00008
42	5	0.06185	0.07189	0.00000	0.00000	0.00000	-0.00373
	6	0.03715	0.04265	0.00000	0.00000	0.00000	-0.00224
	7	0.03097	0.03535	0.00000	0.00000	0.00000	-0.00187
43	5	0.00000	0.13094	0.00000	0.00000	0.00000	-0.00685
	6	0.00000	0.07812	0.00000	0.00000	0.00000	-0.00411
	7	0.00000	0.06492	0.00000	0.00000	0.00000	-0.00343

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	5	12.46	0.00	0.00	0.00	0.00	0.00
	6	7.52	0.00	0.00	0.00	0.00	0.00
	7	6.28	0.00	0.00	0.00	0.00	0.00
7	5	56.73	0.00	0.00	0.00	0.00	0.00
	6	34.02	0.00	0.00	0.00	0.00	0.00
	7	28.34	0.00	0.00	0.00	0.00	0.00
11	5	38.74	0.00	0.00	0.00	0.00	0.00
	6	22.96	0.00	0.00	0.00	0.00	0.00
	7	19.01	0.00	0.00	0.00	0.00	0.00
35	5	-38.86	0.00	0.00	0.00	0.00	0.00
	6	-23.03	0.00	0.00	0.00	0.00	0.00
	7	-19.07	0.00	0.00	0.00	0.00	0.00
39	5	-56.75	0.00	0.00	0.00	0.00	0.00
	6	-34.03	0.00	0.00	0.00	0.00	0.00
	7	-28.35	0.00	0.00	0.00	0.00	0.00
43	5	-12.40	0.00	0.00	0.00	0.00	0.00
	6	-7.49	0.00	0.00	0.00	0.00	0.00
	7	-6.25	0.00	0.00	0.00	0.00	0.00
22	5	0.00	-2.38	0.00	0.00	0.00	0.00
	6	0.00	-1.32	0.00	0.00	0.00	0.00
	7	0.00	-1.05	0.00	0.00	0.00	0.00
24	5	0.00	-2.39	0.00	0.00	0.00	0.00
	6	0.00	-1.33	0.00	0.00	0.00	0.00
	7	0.00	-1.06	0.00	0.00	0.00	0.00
16	5	-28.58	-68.59	0.00	0.00	0.00	0.00
	6	-16.82	-40.39	0.00	0.00	0.00	0.00
	7	-13.88	-33.35	0.00	0.00	0.00	0.00
30	5	28.66	-68.59	0.00	0.00	0.00	0.00
	6	16.87	-40.39	0.00	0.00	0.00	0.00
	7	13.92	-33.35	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	5	3	91.86	4.36	0.00	0.00	0.00	-50.00
		4	-91.78	-4.30	0.00	0.00	0.00	55.65
	6	3	55.08	2.65	0.00	0.00	0.00	-30.00
		4	-55.00	-2.58	0.00	0.00	0.00	33.42
	7	3	45.89	2.22	0.00	0.00	0.00	-25.00
		4	-45.82	-2.16	0.00	0.00	0.00	27.86
4	5	4	91.61	-7.00	0.00	0.00	0.00	-55.65
		5	-91.51	7.07	0.00	0.00	0.00	44.67
	6	4	54.91	-4.19	0.00	0.00	0.00	-33.42
		5	-54.81	4.25	0.00	0.00	0.00	26.83
	7	4	45.74	-3.48	0.00	0.00	0.00	-27.86
		5	-45.63	3.55	0.00	0.00	0.00	22.37
5	5	5	89.89	-18.53	0.00	0.00	0.00	-44.67
		6	-89.79	18.58	0.00	0.00	0.00	15.61
	6	5	53.83	-11.12	0.00	0.00	0.00	-26.83
		6	-53.73	11.17	0.00	0.00	0.00	9.38
	7	5	44.83	-9.27	0.00	0.00	0.00	-22.37
		6	-44.72	9.32	0.00	0.00	0.00	7.82
6	5	6	86.81	-29.51	0.00	0.00	0.00	-15.61
		7	-86.70	29.55	0.00	0.00	0.00	-30.51
	6	6	51.94	-17.71	0.00	0.00	0.00	-9.38
		7	-51.83	17.75	0.00	0.00	0.00	-18.31
	7	6	43.23	-14.76	0.00	0.00	0.00	-7.82
		7	-43.11	14.80	0.00	0.00	0.00	-15.26
7	5	7	71.15	14.87	0.00	0.00	0.00	30.51
		8	-71.03	-14.85	0.00	0.00	0.00	-7.20
	6	7	42.50	8.91	0.00	0.00	0.00	18.31
		8	-42.38	-8.89	0.00	0.00	0.00	-4.35
	7	7	35.34	7.42	0.00	0.00	0.00	15.26
		8	-35.23	-7.40	0.00	0.00	0.00	-3.64
8	5	8	72.35	5.63	0.00	0.00	0.00	7.20
		9	-72.23	-5.62	0.00	0.00	0.00	1.59
	6	8	43.17	3.39	0.00	0.00	0.00	4.35
		9	-43.05	-3.38	0.00	0.00	0.00	0.94
	7	8	35.88	2.83	0.00	0.00	0.00	3.64
		9	-35.76	-2.82	0.00	0.00	0.00	0.77
9	5	9	72.37	3.27	0.00	0.00	0.00	1.59
		10	-72.27	-3.26	0.00	0.00	0.00	2.86
	6	9	43.14	1.92	0.00	0.00	0.00	0.94
		10	-43.04	-1.91	0.00	0.00	0.00	1.67
	7	9	35.84	1.58	0.00	0.00	0.00	0.77
		10	-35.73	-1.58	0.00	0.00	0.00	1.38

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
10	5	10	71.47	11.17	0.00	0.00	0.00	-2.86
		11	-71.37	-11.16	0.00	0.00	0.00	18.15
	6	10	42.57	6.63	0.00	0.00	0.00	-1.67
		11	-42.46	-6.61	0.00	0.00	0.00	10.74
	7	10	35.35	5.49	0.00	0.00	0.00	-1.38
		11	-35.24	-5.47	0.00	0.00	0.00	8.88
11	5	11	80.31	-18.60	0.00	0.00	0.00	-18.15
		12	-80.21	18.63	0.00	0.00	0.00	-7.19
	6	11	47.76	-11.01	0.00	0.00	0.00	-10.74
		12	-47.66	11.04	0.00	0.00	0.00	-4.27
	7	11	39.63	-9.11	0.00	0.00	0.00	-8.88
		12	-39.53	9.14	0.00	0.00	0.00	-3.54
12	5	12	81.89	-8.65	0.00	0.00	0.00	7.19
		13	-81.79	8.70	0.00	0.00	0.00	-19.05
	6	12	48.65	-5.11	0.00	0.00	0.00	4.27
		13	-48.56	5.15	0.00	0.00	0.00	-11.28
	7	12	40.35	-4.22	0.00	0.00	0.00	3.54
		13	-40.25	4.26	0.00	0.00	0.00	-9.34
13	5	13	82.25	-0.34	0.00	0.00	0.00	19.05
		14	-82.16	0.39	0.00	0.00	0.00	-19.55
	6	13	48.83	-0.19	0.00	0.00	0.00	11.28
		14	-48.74	0.24	0.00	0.00	0.00	-11.57
	7	13	40.48	-0.15	0.00	0.00	0.00	9.34
		14	-40.39	0.20	0.00	0.00	0.00	-9.58
14	5	14	81.67	8.99	0.00	0.00	0.00	19.55
		15	-81.58	-8.93	0.00	0.00	0.00	-7.27
	6	14	48.45	5.32	0.00	0.00	0.00	11.57
		15	-48.36	-5.26	0.00	0.00	0.00	-4.32
	7	14	40.15	4.41	0.00	0.00	0.00	9.58
		15	-40.06	-4.35	0.00	0.00	0.00	-3.58
15	5	15	79.94	18.55	0.00	0.00	0.00	7.27
		16	-79.87	-18.48	0.00	0.00	0.00	17.91
	6	15	47.39	10.97	0.00	0.00	0.00	4.32
		16	-47.32	-10.90	0.00	0.00	0.00	10.55
	7	15	39.26	9.07	0.00	0.00	0.00	3.58
		16	-39.18	-9.00	0.00	0.00	0.00	8.71
16	5	16	10.40	-5.10	0.00	0.00	0.00	-17.91
		17	-10.33	5.18	0.00	0.00	0.00	10.89
	6	16	6.41	-2.97	0.00	0.00	0.00	-10.55
		17	-6.34	3.04	0.00	0.00	0.00	6.44
	7	16	5.41	-2.43	0.00	0.00	0.00	-8.71
		17	-5.35	2.51	0.00	0.00	0.00	5.33
17	5	17	10.83	-4.01	0.00	0.00	0.00	-10.89
		18	-10.77	4.10	0.00	0.00	0.00	5.36

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	6	17	6.64	-2.33	0.00	0.00	0.00	-6.44
		18	-6.58	2.42	0.00	0.00	0.00	3.21
	7	17	5.59	-1.91	0.00	0.00	0.00	-5.33
		18	-5.53	1.99	0.00	0.00	0.00	2.67
18	5	18	11.17	-2.83	0.00	0.00	0.00	-5.36
		19	-11.12	2.92	0.00	0.00	0.00	1.43
	6	18	6.81	-1.64	0.00	0.00	0.00	-3.21
		19	-6.76	1.73	0.00	0.00	0.00	0.90
	7	18	5.72	-1.34	0.00	0.00	0.00	-2.67
		19	-5.67	1.44	0.00	0.00	0.00	0.76
19	5	19	11.38	-1.66	0.00	0.00	0.00	-1.43
		20	-11.34	1.76	0.00	0.00	0.00	-0.90
	6	19	6.91	-0.97	0.00	0.00	0.00	-0.90
		20	-6.87	1.07	0.00	0.00	0.00	-0.49
	7	19	5.79	-0.80	0.00	0.00	0.00	-0.76
		20	-5.75	0.89	0.00	0.00	0.00	-0.39
20	5	20	11.46	-0.51	0.00	0.00	0.00	0.90
		21	-11.43	0.61	0.00	0.00	0.00	-1.67
	6	20	6.95	-0.31	0.00	0.00	0.00	0.49
		21	-6.92	0.41	0.00	0.00	0.00	-0.98
	7	20	5.82	-0.26	0.00	0.00	0.00	0.39
		21	-5.79	0.36	0.00	0.00	0.00	-0.81
21	5	21	11.43	0.67	0.00	0.00	0.00	1.67
		22	-11.41	-0.57	0.00	0.00	0.00	-0.83
	6	21	6.92	0.37	0.00	0.00	0.00	0.98
		22	-6.90	-0.26	0.00	0.00	0.00	-0.56
	7	21	5.79	0.29	0.00	0.00	0.00	0.81
		22	-5.78	-0.19	0.00	0.00	0.00	-0.49
22	5	22	11.14	-0.54	0.00	0.00	0.00	0.83
		23	-11.13	0.65	0.00	0.00	0.00	-1.64
	6	22	6.75	-0.29	0.00	0.00	0.00	0.56
		23	-6.75	0.39	0.00	0.00	0.00	-1.02
	7	22	5.66	-0.22	0.00	0.00	0.00	0.49
		23	-5.65	0.33	0.00	0.00	0.00	-0.86
23	5	23	11.13	0.66	0.00	0.00	0.00	1.64
		24	-11.14	-0.55	0.00	0.00	0.00	-0.82
	6	23	6.75	0.40	0.00	0.00	0.00	1.02
		24	-6.75	-0.29	0.00	0.00	0.00	-0.55
	7	23	5.65	0.33	0.00	0.00	0.00	0.86
		24	-5.66	-0.23	0.00	0.00	0.00	-0.48
24	5	24	11.41	-0.57	0.00	0.00	0.00	0.82
		25	-11.43	0.67	0.00	0.00	0.00	-1.66
	6	24	6.90	-0.27	0.00	0.00	0.00	0.55
		25	-6.92	0.37	0.00	0.00	0.00	-0.98

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	7	24	5.78	-0.19	0.00	0.00	0.00	0.48
		25	-5.79	0.29	0.00	0.00	0.00	-0.81
25	5	25	11.43	0.61	0.00	0.00	0.00	1.66
		26	-11.46	-0.51	0.00	0.00	0.00	-0.90
	6	25	6.92	0.41	0.00	0.00	0.00	0.98
		26	-6.95	-0.31	0.00	0.00	0.00	-0.49
	7	25	5.79	0.36	0.00	0.00	0.00	0.81
		26	-5.82	-0.26	0.00	0.00	0.00	-0.38
26	5	26	11.34	1.72	0.00	0.00	0.00	0.90
		27	-11.38	-1.63	0.00	0.00	0.00	1.40
	6	26	6.87	1.05	0.00	0.00	0.00	0.49
		27	-6.91	-0.95	0.00	0.00	0.00	0.88
	7	26	5.76	0.88	0.00	0.00	0.00	0.38
		27	-5.80	-0.78	0.00	0.00	0.00	0.75
27	5	27	11.11	2.95	0.00	0.00	0.00	-1.40
		28	-11.16	-2.86	0.00	0.00	0.00	5.36
	6	27	6.76	1.75	0.00	0.00	0.00	-0.88
		28	-6.81	-1.66	0.00	0.00	0.00	3.20
	7	27	5.67	1.45	0.00	0.00	0.00	-0.75
		28	-5.72	-1.36	0.00	0.00	0.00	2.67
28	5	28	10.77	4.09	0.00	0.00	0.00	-5.36
		29	-10.83	-4.01	0.00	0.00	0.00	10.88
	6	28	6.58	2.41	0.00	0.00	0.00	-3.20
		29	-6.64	-2.33	0.00	0.00	0.00	6.43
	7	28	5.53	1.99	0.00	0.00	0.00	-2.67
		29	-5.59	-1.91	0.00	0.00	0.00	5.32
29	5	29	10.33	5.17	0.00	0.00	0.00	-10.88
		30	-10.40	-5.09	0.00	0.00	0.00	17.90
	6	29	6.34	3.04	0.00	0.00	0.00	-6.43
		30	-6.41	-2.96	0.00	0.00	0.00	10.54
	7	29	5.35	2.51	0.00	0.00	0.00	-5.32
		30	-5.42	-2.43	0.00	0.00	0.00	8.70
30	5	30	79.92	-18.42	0.00	0.00	0.00	-17.90
		31	-80.00	18.49	0.00	0.00	0.00	-7.19
	6	30	47.35	-10.86	0.00	0.00	0.00	-10.54
		31	-47.43	10.93	0.00	0.00	0.00	-4.27
	7	30	39.21	-8.97	0.00	0.00	0.00	-8.70
		31	-39.29	9.04	0.00	0.00	0.00	-3.54
31	5	31	81.63	-8.86	0.00	0.00	0.00	7.19
		32	-81.72	8.92	0.00	0.00	0.00	-19.37
	6	31	48.39	-5.22	0.00	0.00	0.00	4.27
		32	-48.48	5.28	0.00	0.00	0.00	-11.47
	7	31	40.08	-4.31	0.00	0.00	0.00	3.54
		32	-40.17	4.37	0.00	0.00	0.00	-9.50

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
32	5	32	82.20	-0.06	0.00	0.00	0.00	19.37
		33	-82.29	0.11	0.00	0.00	0.00	-19.50
	6	32	48.76	-0.03	0.00	0.00	0.00	11.47
		33	-48.85	0.08	0.00	0.00	0.00	-11.55
	7	32	40.41	-0.02	0.00	0.00	0.00	9.50
		33	-40.50	0.07	0.00	0.00	0.00	-9.56
33	5	33	81.76	9.33	0.00	0.00	0.00	19.50
		34	-81.86	-9.29	0.00	0.00	0.00	-6.81
	6	33	48.54	5.53	0.00	0.00	0.00	11.55
		34	-48.64	-5.49	0.00	0.00	0.00	-4.04
	7	33	40.24	4.58	0.00	0.00	0.00	9.56
		34	-40.34	-4.54	0.00	0.00	0.00	-3.35
34	5	34	80.36	18.14	0.00	0.00	0.00	6.81
		35	-80.46	-18.11	0.00	0.00	0.00	17.92
	6	34	47.75	10.75	0.00	0.00	0.00	4.04
		35	-47.85	-10.72	0.00	0.00	0.00	10.60
	7	34	39.60	8.90	0.00	0.00	0.00	3.35
		35	-39.70	-8.87	0.00	0.00	0.00	8.77
35	5	35	71.36	-11.19	0.00	0.00	0.00	-17.92
		36	-71.47	11.21	0.00	0.00	0.00	2.58
	6	35	42.46	-6.63	0.00	0.00	0.00	-10.60
		36	-42.56	6.65	0.00	0.00	0.00	1.51
	7	35	35.24	-5.49	0.00	0.00	0.00	-8.77
		36	-35.34	5.51	0.00	0.00	0.00	1.24
36	5	36	72.29	-2.77	0.00	0.00	0.00	-2.58
		37	-72.39	2.77	0.00	0.00	0.00	-1.19
	6	36	43.05	-1.62	0.00	0.00	0.00	-1.51
		37	-43.15	1.62	0.00	0.00	0.00	-0.70
	7	36	35.74	-1.33	0.00	0.00	0.00	-1.24
		37	-35.85	1.34	0.00	0.00	0.00	-0.57
37	5	37	72.23	-5.59	0.00	0.00	0.00	-1.19
		38	-72.35	5.59	0.00	0.00	0.00	-7.55
	6	37	43.05	-3.36	0.00	0.00	0.00	-0.70
		38	-43.17	3.37	0.00	0.00	0.00	-4.56
	7	37	35.76	-2.80	0.00	0.00	0.00	-0.57
		38	-35.88	2.81	0.00	0.00	0.00	-3.81
38	5	38	71.04	-14.81	0.00	0.00	0.00	7.55
		39	-71.16	14.83	0.00	0.00	0.00	-30.80
	6	38	42.39	-8.87	0.00	0.00	0.00	4.56
		39	-42.50	8.89	0.00	0.00	0.00	-18.49
	7	38	35.23	-7.38	0.00	0.00	0.00	3.81
		39	-35.35	7.40	0.00	0.00	0.00	-15.41
39	5	39	86.53	30.13	0.00	0.00	0.00	30.80
		40	-86.65	-30.09	0.00	0.00	0.00	16.13

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	6	39	51.73	18.09	0.00	0.00	0.00	18.49
		40	-51.84	-18.05	0.00	0.00	0.00	9.69
	7	39	43.03	15.09	0.00	0.00	0.00	15.41
		40	-43.15	-15.05	0.00	0.00	0.00	8.08
40	5	40	89.81	18.64	0.00	0.00	0.00	-16.13
		41	-89.92	-18.58	0.00	0.00	0.00	45.26
	6	40	53.74	11.20	0.00	0.00	0.00	-9.69
		41	-53.85	-11.15	0.00	0.00	0.00	27.18
	7	40	44.73	9.34	0.00	0.00	0.00	-8.08
		41	-44.84	-9.29	0.00	0.00	0.00	22.67
41	5	41	91.58	6.63	0.00	0.00	0.00	-45.26
		42	-91.68	-6.56	0.00	0.00	0.00	55.60
	6	41	54.85	3.99	0.00	0.00	0.00	-27.18
		42	-54.95	-3.92	0.00	0.00	0.00	33.38
	7	41	45.67	3.33	0.00	0.00	0.00	-22.67
		42	-45.77	-3.26	0.00	0.00	0.00	27.83
42	5	42	91.82	-4.25	0.00	0.00	0.00	-55.60
		43	-91.89	4.32	0.00	0.00	0.00	50.00
	6	42	55.03	-2.56	0.00	0.00	0.00	-33.38
		43	-55.10	2.62	0.00	0.00	0.00	30.00
	7	42	45.84	-2.14	0.00	0.00	0.00	-27.83
		43	-45.91	2.20	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

71. LOAD LIST 5
72. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
* 3	ST W8X 31	FAIL	AISC- H1-2	1.488	5
		91.78 C	0.00	55.65	1.31
* 4	ST W8X 31	FAIL	AISC- H1-2	1.487	5
		91.61 C	0.00	-55.65	0.00
* 5	ST W8X 31	FAIL	AISC- H1-2	1.276	5
		89.89 C	0.00	-44.67	0.00
* 6	ST W8X 31	FAIL	AISC- H1-2	1.000	5
		86.70 C	0.00	-30.51	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.921	5
		71.15 C	0.00	30.51	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.499	5
		72.35 C	0.00	7.20	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.419	5
		72.27 C	0.00	2.86	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.695	5
		71.37 C	0.00	18.15	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.740	5
		80.31 C	0.00	-18.15	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.765	5
		81.79 C	0.00	-19.05	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.776	5
		82.16 C	0.00	-19.55	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.773	5
		81.67 C	0.00	19.55	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.734	5
		79.87 C	0.00	17.91	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.382	5
		10.40 C	0.00	-17.91	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.256	5
		10.83 C	0.00	-10.89	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.156	5
		11.17 C	0.00	-5.36	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.085	5
		11.38 C	0.00	-1.43	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.090	5
		11.43 C	0.00	-1.67	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.090	5
		11.43 C	0.00	1.67	0.00
22	ST W8X 31	PASS	AISC- H1-3	0.088	5
		11.13 C	0.00	-1.64	1.37
23	ST W8X 31	PASS	AISC- H1-3	0.088	5
		11.13 C	0.00	1.64	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.089	5
		11.43 C	0.00	-1.66	1.36
25	ST W8X 31	PASS	AISC- H1-3	0.090	5
		11.43 C	0.00	1.66	0.00
26	ST W8X 31	PASS	AISC- H1-3	0.084	5
		11.38 C	0.00	1.40	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.156	5
		11.16 C	0.00	5.36	1.36
28	ST W8X 31	PASS	AISC- H1-3	0.256	5
		10.83 C	0.00	10.88	1.36
29	ST W8X 31	PASS	AISC- H1-3	0.382	5
		10.40 C	0.00	17.90	1.37
30	ST W8X 31	PASS	AISC- H1-2	0.734	5
		79.92 C	0.00	-17.90	0.00
31	ST W8X 31	PASS	AISC- H1-2	0.770	5
		81.72 C	0.00	-19.37	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.775	5
		82.29 C	0.00	-19.50	1.36
33	ST W8X 31	PASS	AISC- H1-2	0.773	5
		81.76 C	0.00	19.50	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.737	5
		80.46 C	0.00	17.92	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.691	5
		71.36 C	0.00	-17.92	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.414	5
		72.29 C	0.00	-2.58	0.00
37	ST W8X 31	PASS	AISC- H1-2	0.506	5
		72.35 C	0.00	-7.55	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.927	5
		71.16 C	0.00	-30.80	1.57
* 39	ST W8X 31	FAIL	AISC- H1-2	1.005	5
		86.53 C	0.00	30.80	0.00
* 40	ST W8X 31	FAIL	AISC- H1-2	1.287	5
		89.92 C	0.00	45.26	1.57
* 41	ST W8X 31	FAIL	AISC- H1-2	1.486	5
		91.68 C	0.00	55.60	1.57
* 42	ST W8X 31	FAIL	AISC- H1-2	1.487	5
		91.82 C	0.00	-55.60	0.00

*************** END OF TABULATED RESULT OF DESIGN **************

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73. LOAD LIST 6
74. CHECK CODE ALL
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STAAD-III CODE CHECKING - (AISC)
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ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.893	6
		55.00 C	0.00	33.42	1.31
4	ST W8X 31	PASS	AISC- H1-2	0.892	6
		54.91 C	0.00	-33.42	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.766	6
		53.83 C	0.00	-26.83	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.599	6
		51.83 C	0.00	-18.31	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.552	6
		42.50 C	0.00	18.31	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.299	6
		43.17 C	0.00	4.35	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.249	6
		43.04 C	0.00	1.67	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.412	6
		42.46 C	0.00	10.74	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.439	6
		47.76 C	0.00	-10.74	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.453	6
		48.56 C	0.00	-11.28	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.460	6
		48.74 C	0.00	-11.57	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.458	6
		48.45 C	0.00	11.57	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.434	6
		47.32 C	0.00	10.55	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.227	6
		6.41 C	0.00	-10.55	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.152	6
		6.64 C	0.00	-6.44	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.094	6
		6.81 C	0.00	-3.21	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.052	6
		6.91 C	0.00	-0.90	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.054	6
		6.92 C	0.00	-0.98	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.054	6
		6.92 C	0.00	0.98	0.00
22	ST W8X 31	PASS	AISC- H1-3	0.054	6
		6.75 C	0.00	-1.02	1.37
23	ST W8X 31	PASS	AISC- H1-3	0.054	6
		6.75 C	0.00	1.02	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.054	6
		6.92 C	0.00	-0.98	1.36
25	ST W8X 31	PASS	AISC- H1-3	0.054	6
		6.92 C	0.00	0.98	0.00
26	ST W8X 31	PASS	AISC- H1-3	0.052	6
		6.91 C	0.00	0.88	1.37

.L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.094	6
		6.81 C	0.00	3.20	1.36
28	ST W8X 31	PASS	AISC- H1-3	0.152	6
		6.64 C	0.00	6.43	1.36
29	ST W8X 31	PASS	AISC- H1-3	0.227	6
		6.41 C	0.00	10.54	1.37
30	ST W8X 31	PASS	AISC- H1-2	0.434	6
		47.35 C	0.00	-10.54	0.00
31	ST W8X 31	PASS	AISC- H1-2	0.456	6
		48.48 C	0.00	-11.47	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.460	6
		48.85 C	0.00	-11.55	1.36
33	ST W8X 31	PASS	AISC- H1-2	0.458	6
		48.54 C	0.00	11.55	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.437	6
		47.85 C	0.00	10.60	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.410	6
		42.46 C	0.00	-10.60	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.246	6
		43.05 C	0.00	-1.51	0.00
37	ST W8X 31	PASS	AISC- H1-2	0.303	6
		43.17 C	0.00	-4.56	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.555	6
		42.50 C	0.00	-18.49	1.57
39	ST W8X 31	PASS	AISC- H1-2	0.602	6
		51.73 C	0.00	18.49	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.772	6
		53.85 C	0.00	27.18	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.892	6
		54.95 C	0.00	33.38	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.892	6
		55.03 C	0.00	-33.38	0.00

************** END OF TABULATED RESULT OF DESIGN **************

75. LOAD LIST 7
76. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.744	7
		45.82 C	0.00	27.86	1.31
4	ST W8X 31	PASS	AISC- H1-2	0.744	7
		45.74 C	0.00	-27.86	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.638	7
		44.83 C	0.00	-22.37	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.499	7
		43.11 C	0.00	-15.26	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.460	7
		35.34 C	0.00	15.26	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.249	7
		35.88 C	0.00	3.64	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.207	7
		35.73 C	0.00	1.38	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.342	7
		35.24 C	0.00	8.88	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.364	7
		39.63 C	0.00	-8.88	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.376	7
		40.25 C	0.00	-9.34	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.381	7
		40.39 C	0.00	-9.58	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.380	7
		40.15 C	0.00	9.58	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.359	7
		39.18 C	0.00	8.71	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.188	7
		5.41 C	0.00	-8.71	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.127	7
		5.59 C	0.00	-5.33	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.078	7
		5.72 C	0.00	-2.67	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.044	7
		5.79 C	0.00	-0.76	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.045	7
		5.79 C	0.00	-0.81	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.045	7
		5.79 C	0.00	0.81	0.00
22	ST W8X 31	PASS	AISC- H1-3	0.045	7
		5.65 C	0.00	-0.86	1.37
23	ST W8X 31	PASS	AISC- H1-3	0.045	7
		5.65 C	0.00	0.86	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.045	7
		5.79 C	0.00	-0.81	1.36
25	ST W8X 31	PASS	AISC- H1-3	0.045	7
		5.79 C	0.00	0.81	0.00
26	ST W8X 31	PASS	AISC- H1-3	0.044	7
		5.80 C	0.00	0.75	1.37

.L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.078	7
		5.72 C	0.00	2.67	1.36
28	ST W8X 31	PASS	AISC- H1-3	0.127	7
		5.59 C	0.00	5.32	1.36
29	ST W8X 31	PASS	AISC- H1-3	0.188	7
		5.42 C	0.00	8.70	1.37
30	ST W8X 31	PASS	AISC- H1-2	0.359	7
		39.21 C	0.00	-8.70	0.00
31	ST W8X 31	PASS	AISC- H1-2	0.378	7
		40.17 C	0.00	-9.50	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.381	7
		40.50 C	0.00	-9.56	1.36
33	ST W8X 31	PASS	AISC- H1-2	0.380	7
		40.24 C	0.00	9.56	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.362	7
		39.70 C	0.00	8.77	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.340	7
		35.24 C	0.00	-8.77	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.204	7
		35.74 C	0.00	-1.24	0.00
37	ST W8X 31	PASS	AISC- H1-2	0.252	7
		35.88 C	0.00	-3.81	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.462	7
		35.35 C	0.00	-15.41	1.57
39	ST W8X 31	PASS	AISC- H1-2	0.501	7
		43.03 C	0.00	15.41	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.644	7
		44.84 C	0.00	22.67	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.743	7
		45.77 C	0.00	27.83	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.744	7
		45.84 C	0.00	-27.83	0.00

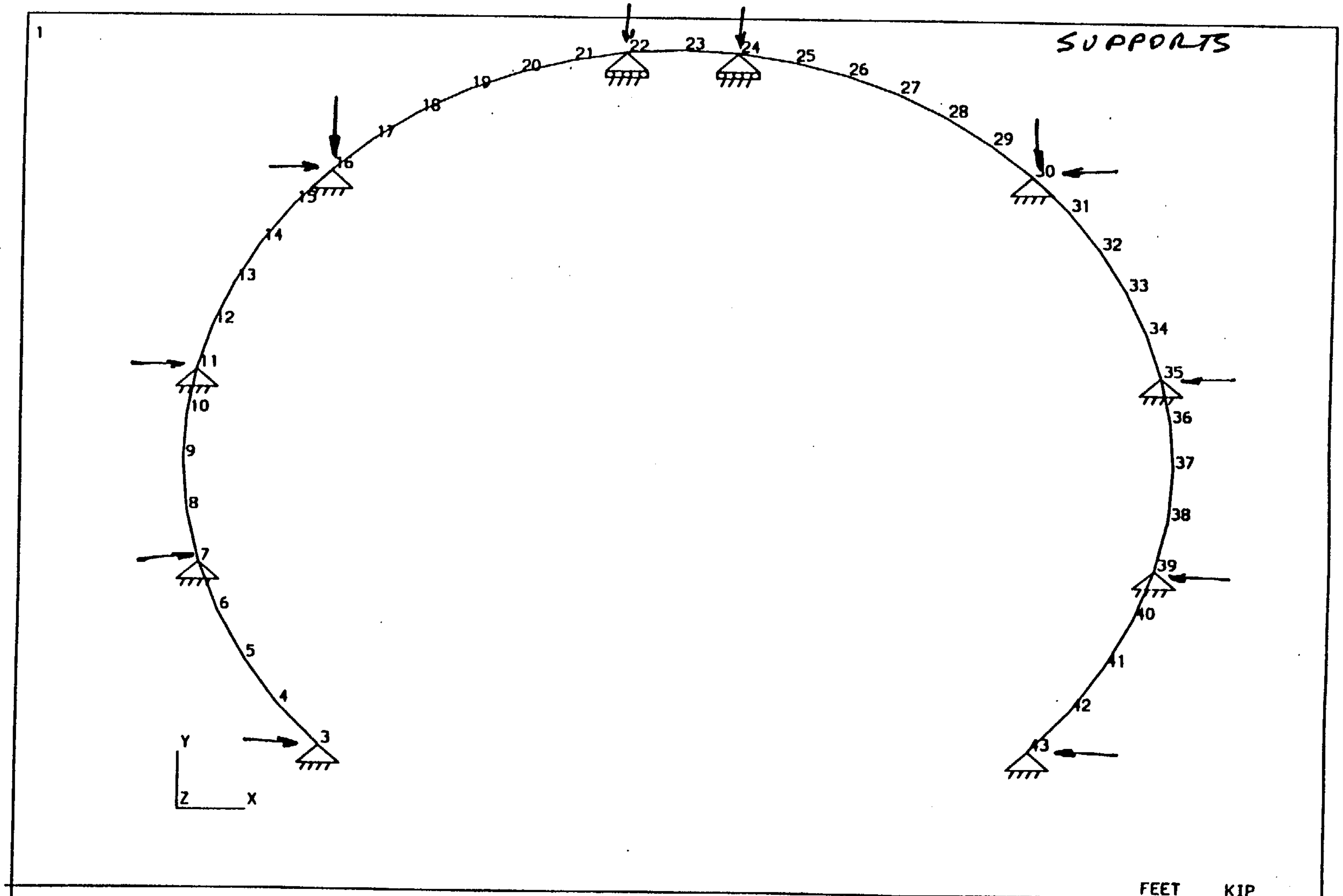
************** END OF TABULATED RESULT OF DESIGN **************

77. PLOT DISPLACEMENT FILE
78. PLOT STRESS FILE
79. PLOT BENDING FILE
80. FINISH

*************** END OF STAAD-III ***************

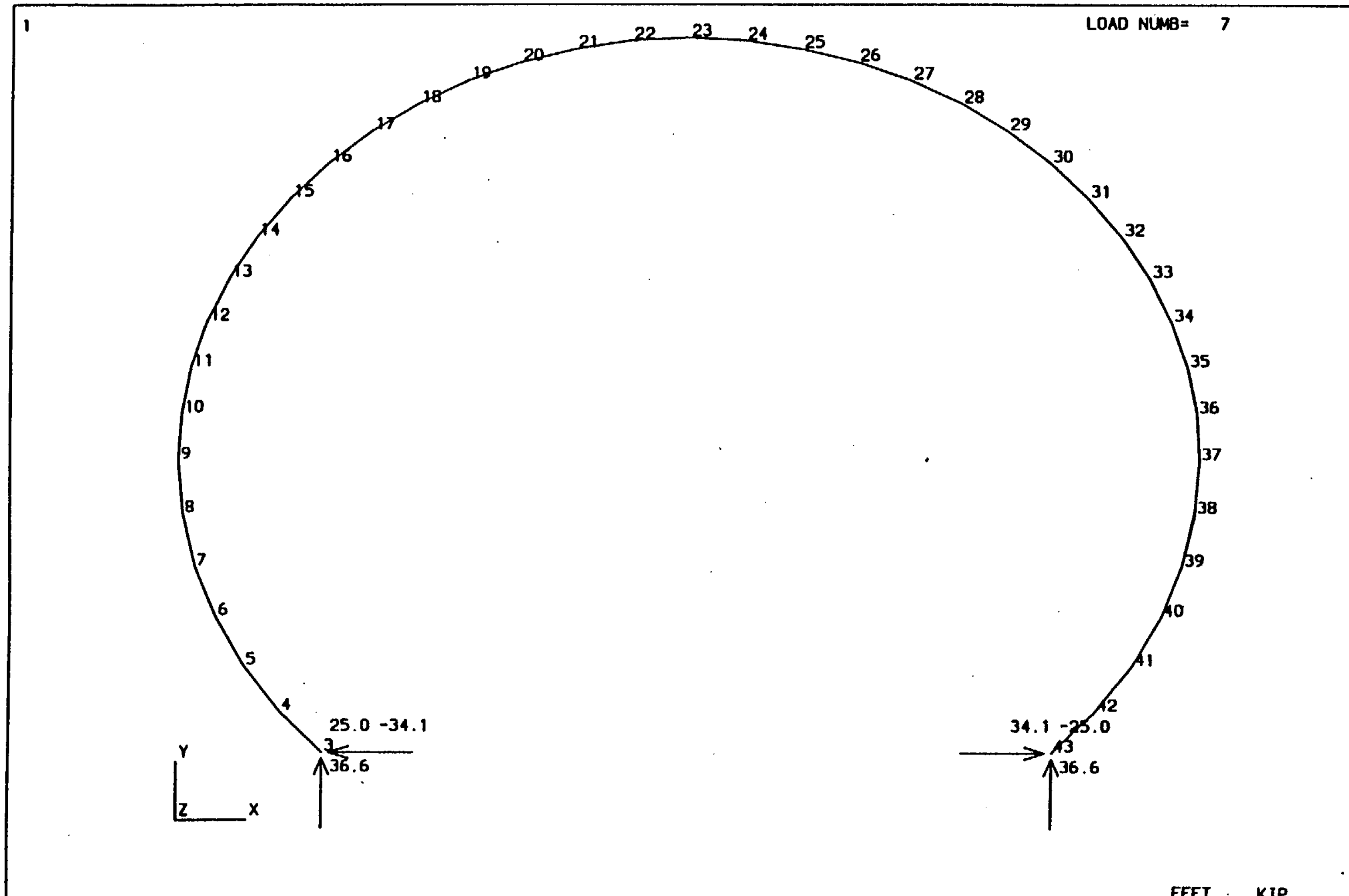
DATE= JUL 17,1995 TIME= 15:56: 2 ******

****
* For questions on STAAD-III/ISDS, contact: *



COMPANY: M&O
DATE: APR 22, 1995

S T A A D P L - P L O T (REVISION 16.0) STZ RVZ
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 41, NM= 40, NE= 0



STAADPL-PLOT (REVISION 16.0) STZRVZ

COMPANY: M&O
DATE: APR 22, 1995

TITLE: STAAD PLANE
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

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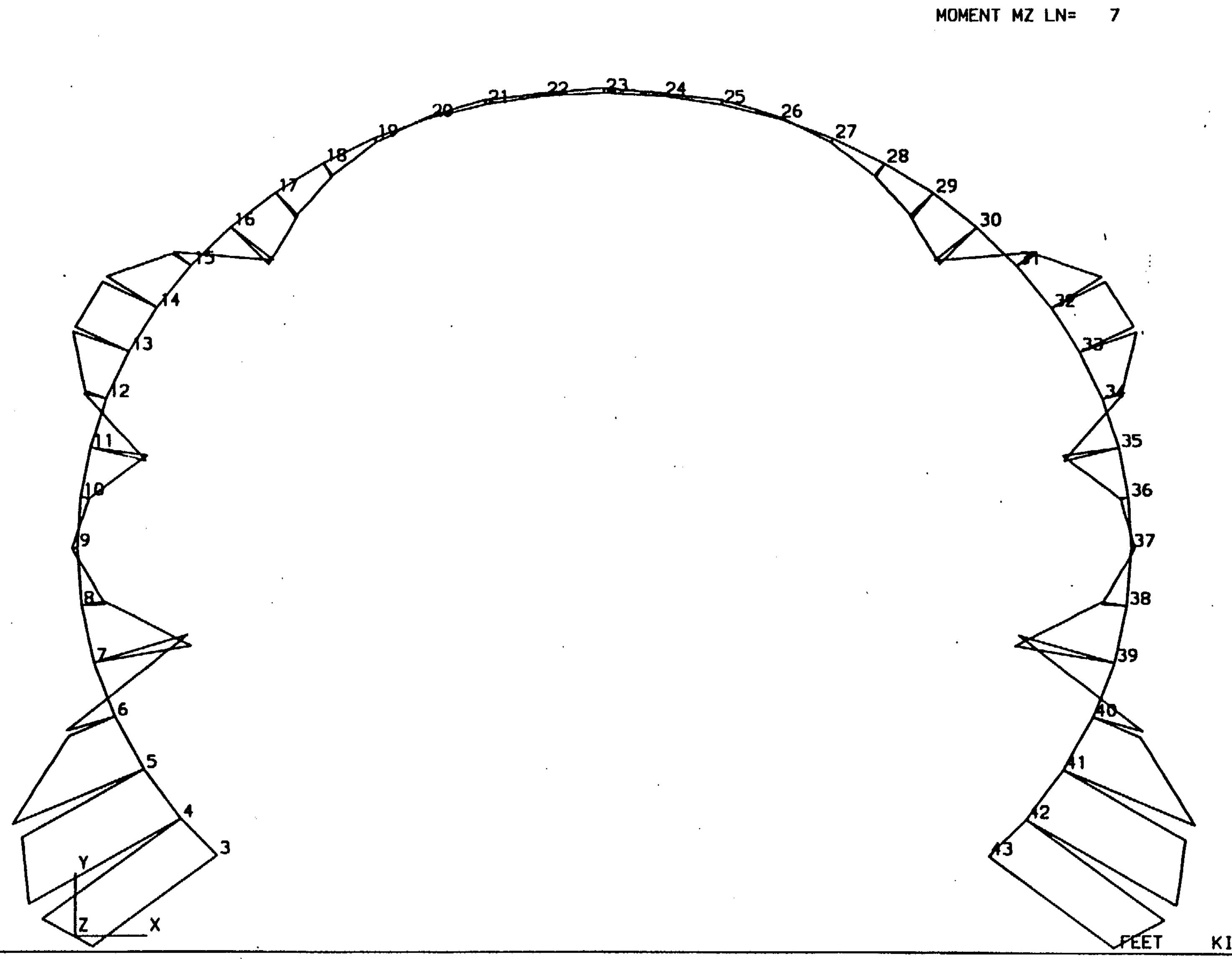


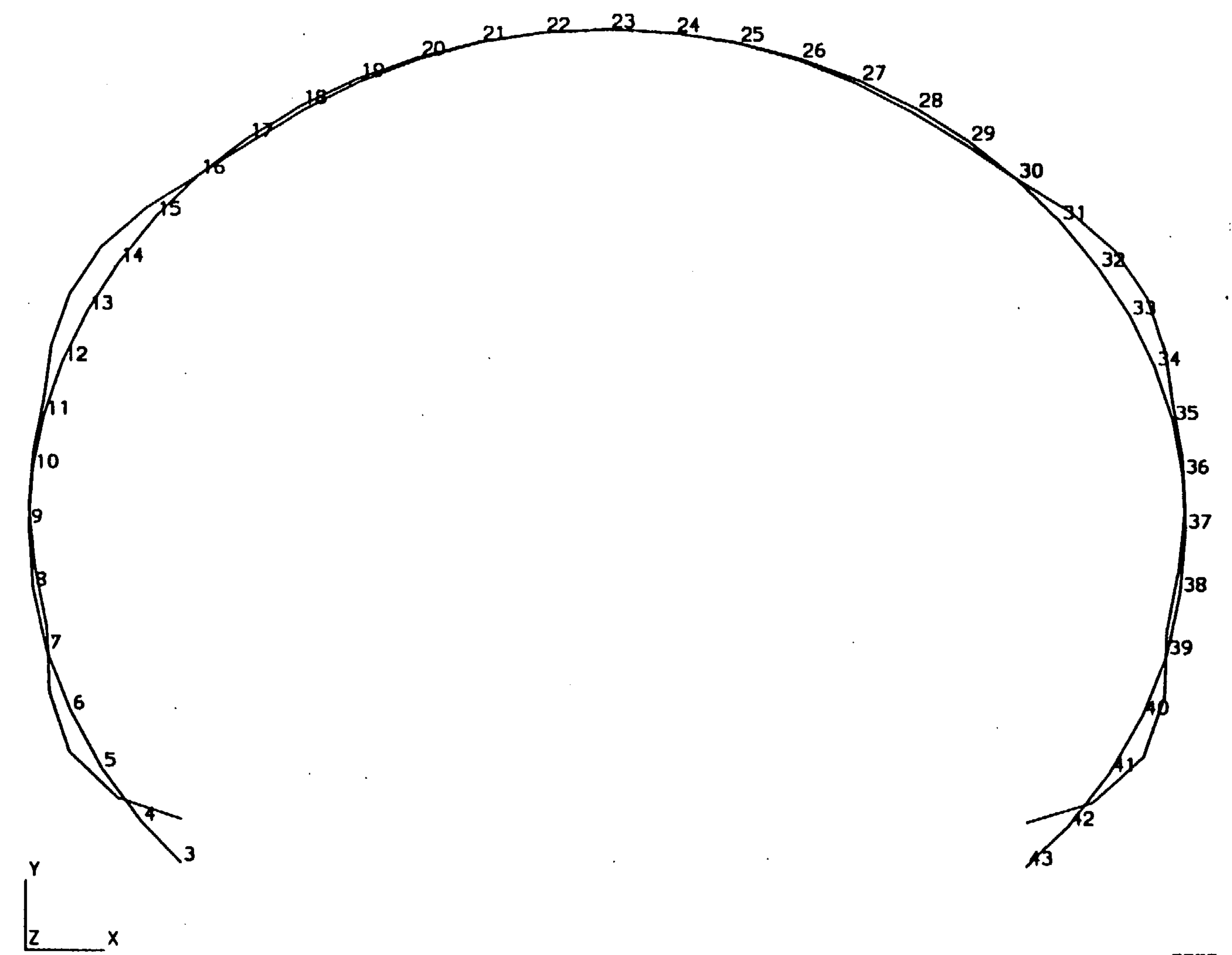
S T A A D P L - P L O T (REVISION 16.0) STLRVZ

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

1

DFDR LOAD= 7



FEET KIP

S T A A D P L - P L O T (REVISION 16.0) STLRV2

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

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**************************************************
*                                                *
*          S T A A D - III                       *
*          Revision 16.0b                        *
*          Proprietary Program of                *
*          RESEARCH ENGINEERS, Inc.              *
*          Date=    JUL 18, 1995                 *
*          Time=     8:41:10                     *
*                                                *
**************************************************

 1. STAAD PLANE BABEE0000-01717-0200-00003  ATTACHMENT  I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. * FILE STLRV3A
 4. * 25 TON JACKS APPLIED BOTH SIDES @ 49 DEGREES
 5. UNIT FT KIP
 6. JOINT COORDINATES
 7. 3 2.98 2.45 ; 4 2.43 3.13
 8. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
 9. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
10. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
11. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
12. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
13. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
14. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
15. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
16. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
17. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.35 2.45
18. MEMBER INCIDENCE
19. 3 3 4 42
20. UNIT KIP INCH
21. MEMBER PROPERTIES
22. 3 TO 42 TA STA W8X31
23. CONSTANTS
24. E 29000.0 ALL
25. DENSITY 0.00028 ALL
26. BETA 0 ALL
27. UNIT FT
28. SUPPORT
29. 3 7 11 35 39 43 FIXED BUT FY MZ
30. 22 24 FIXED BUT FX MZ
31. 16 30 PINNED
32. UNIT KIP
33. LOAD 1
34. SELF WEIGHT Y -1.0
35. LOADING 2
36. * 25 TON JACKS & SIMULTANEOUS JACKING
37. JOINT LOADING
38. 3 FX -32.80
39. 43 FX 32.80
40. 3 FY 37.74
41. 43 FY 37.74
42. 43 MZ -25.00
43. 3 MZ 25.00
44. LOADING COMBINATION 3
45. 1 2.5 2 1.0
46. PERFORM ANALYSIS
```

```
        P R O B L E M   S T A T I S T I C S
        -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    41/   40/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/    1
   TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =    111
   SIZE OF STIFFNESS MATRIX =      666 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =     0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                  8:41:13
++ PROCESSING GLOBAL STIFFNESS MATRIX.                   8:41:14
++ PROCESSING TRIANGULAR FACTORIZATION.                  8:41:14
++ CALCULATING JOINT DISPLACEMENTS.                      8:41:14
++ CALCULATING MEMBER  FORCES.                           8:41:15

  47. LOAD LIST 3
  48. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06081	0.00000	0.00000	0.00000	0.00305
4	3	-0.02014	0.04214	0.00000	0.00000	0.00000	0.00203
5	3	-0.03488	0.02863	0.00000	0.00000	0.00000	0.00030
6	3	-0.02344	0.03053	0.00000	0.00000	0.00000	-0.00079
7	3	0.00000	0.03514	0.00000	0.00000	0.00000	-0.00060
8	3	0.00086	0.03266	0.00000	0.00000	0.00000	-0.00001
9	3	-0.00094	0.02992	0.00000	0.00000	0.00000	0.00002
10	3	-0.00022	0.02759	0.00000	0.00000	0.00000	0.00002
11	3	0.00000	0.02526	0.00000	0.00000	0.00000	0.00036
12	3	-0.01335	0.02641	0.00000	0.00000	0.00000	0.00055
13	3	-0.02214	0.02730	0.00000	0.00000	0.00000	0.00015
14	3	-0.02144	0.02398	0.00000	0.00000	0.00000	-0.00044
15	3	-0.01195	0.01414	0.00000	0.00000	0.00000	-0.00086
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00070
17	3	0.00392	-0.00491	0.00000	0.00000	0.00000	-0.00025
18	3	0.00415	-0.00583	0.00000	0.00000	0.00000	0.00000
19	3	0.00300	-0.00450	0.00000	0.00000	0.00000	0.00011
20	3	0.00176	-0.00244	0.00000	0.00000	0.00000	0.00012
21	3	0.00090	-0.00078	0.00000	0.00000	0.00000	0.00008
22	3	0.00039	0.00000	0.00000	0.00000	0.00000	0.00004
23	3	0.00000	0.00050	0.00000	0.00000	0.00000	0.00000
24	3	-0.00038	0.00000	0.00000	0.00000	0.00000	-0.00004
25	3	-0.00088	-0.00078	0.00000	0.00000	0.00000	-0.00008
26	3	-0.00174	-0.00242	0.00000	0.00000	0.00000	-0.00012
27	3	-0.00298	-0.00447	0.00000	0.00000	0.00000	-0.00011
28	3	-0.00413	-0.00581	0.00000	0.00000	0.00000	0.00000
29	3	-0.00391	-0.00490	0.00000	0.00000	0.00000	0.00025
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00070
31	3	0.01193	0.01412	0.00000	0.00000	0.00000	0.00086
32	3	0.02142	0.02397	0.00000	0.00000	0.00000	0.00044
33	3	0.02223	0.02738	0.00000	0.00000	0.00000	-0.00015
34	3	0.01325	0.02645	0.00000	0.00000	0.00000	-0.00055
35	3	0.00000	0.02525	0.00000	0.00000	0.00000	-0.00036
36	3	0.00017	0.02757	0.00000	0.00000	0.00000	-0.00003
37	3	0.00065	0.02988	0.00000	0.00000	0.00000	-0.00003
38	3	-0.00111	0.03263	0.00000	0.00000	0.00000	0.00002
39	3	0.00000	0.03506	0.00000	0.00000	0.00000	0.00062
40	3	0.02391	0.03043	0.00000	0.00000	0.00000	0.00080
41	3	0.03542	0.02849	0.00000	0.00000	0.00000	-0.00031
42	3	0.02033	0.04237	0.00000	0.00000	0.00000	-0.00206
43	3	0.00000	0.06120	0.00000	0.00000	0.00000	-0.00308

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	4.96	0.00	0.00	0.00	0.00	0.00
7	3	28.01	0.00	0.00	0.00	0.00	0.00
11	3	20.12	0.00	0.00	0.00	0.00	0.00
35	3	-20.18	0.00	0.00	0.00	0.00	0.00
39	3	-28.02	0.00	0.00	0.00	0.00	0.00
43	3	-4.93	0.00	0.00	0.00	0.00	0.00
22	3	0.00	-1.08	0.00	0.00	0.00	0.00
24	3	0.00	-1.09	0.00	0.00	0.00	0.00
16	3	-14.50	-34.52	0.00	0.00	0.00	0.00
30	3	14.54	-34.52	0.00	0.00	0.00	0.00

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	46.85	2.09	0.00	0.00	0.00	-25.00
		4	-46.80	-2.04	0.00	0.00	0.00	26.81
4	3	4	46.76	-2.85	0.00	0.00	0.00	-26.81
		5	-46.66	2.91	0.00	0.00	0.00	22.31
5	3	5	45.92	-8.76	0.00	0.00	0.00	-22.31
		6	-45.81	8.82	0.00	0.00	0.00	8.54
6	3	6	44.37	-14.40	0.00	0.00	0.00	-8.54
		7	-44.26	14.43	0.00	0.00	0.00	-13.97
7	3	7	36.59	7.30	0.00	0.00	0.00	13.97
		8	-36.47	-7.27	0.00	0.00	0.00	-2.54
8	3	8	37.11	2.55	0.00	0.00	0.00	2.54
		9	-36.99	-2.54	0.00	0.00	0.00	1.43
9	3	9	37.02	2.01	0.00	0.00	0.00	1.43
		10	-36.91	-2.00	0.00	0.00	0.00	1.30
10	3	10	36.47	6.04	0.00	0.00	0.00	-1.30
		11	-36.37	-6.03	0.00	0.00	0.00	9.57
11	3	11	40.99	-9.50	0.00	0.00	0.00	-9.57
		12	-40.89	9.53	0.00	0.00	0.00	-3.38
12	3	12	41.75	-4.44	0.00	0.00	0.00	3.38
		13	-41.65	4.48	0.00	0.00	0.00	-9.48
13	3	13	41.89	-0.23	0.00	0.00	0.00	9.48
		14	-41.80	0.28	0.00	0.00	0.00	-9.83
14	3	14	41.56	4.49	0.00	0.00	0.00	9.83
		15	-41.47	-4.43	0.00	0.00	0.00	-3.71
15	3	15	40.65	9.33	0.00	0.00	0.00	3.71
		16	-40.58	-9.26	0.00	0.00	0.00	8.92
16	3	16	5.53	-2.49	0.00	0.00	0.00	-8.92
		17	-5.46	2.57	0.00	0.00	0.00	5.45
17	3	17	5.71	-1.96	0.00	0.00	0.00	-5.45
		18	-5.65	2.04	0.00	0.00	0.00	2.73
18	3	18	5.85	-1.38	0.00	0.00	0.00	-2.73
		19	-5.80	1.47	0.00	0.00	0.00	0.78

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	5.92	-0.82	0.00	0.00	0.00	-0.78
		20	-5.88	0.91	0.00	0.00	0.00	-0.40
20	3	20	5.95	-0.27	0.00	0.00	0.00	0.40
		21	-5.92	0.37	0.00	0.00	0.00	-0.83
21	3	21	5.92	0.30	0.00	0.00	0.00	0.83
		22	-5.90	-0.20	0.00	0.00	0.00	-0.49
22	3	22	5.78	-0.23	0.00	0.00	0.00	0.49
		23	-5.78	0.34	0.00	0.00	0.00	-0.88
23	3	23	5.78	0.34	0.00	0.00	0.00	0.88
		24	-5.78	-0.24	0.00	0.00	0.00	-0.49
24	3	24	5.90	-0.20	0.00	0.00	0.00	0.49
		25	-5.92	0.30	0.00	0.00	0.00	-0.83
25	3	25	5.92	0.37	0.00	0.00	0.00	0.83
		26	-5.95	-0.27	0.00	0.00	0.00	-0.40
26	3	26	5.89	0.89	0.00	0.00	0.00	0.40
		27	-5.93	-0.80	0.00	0.00	0.00	0.76
27	3	27	5.79	1.49	0.00	0.00	0.00	-0.76
		28	-5.84	-1.40	0.00	0.00	0.00	2.73
28	3	28	5.65	2.04	0.00	0.00	0.00	-2.73
		29	-5.71	-1.96	0.00	0.00	0.00	5.45
29	3	29	5.46	2.57	0.00	0.00	0.00	-5.45
		30	-5.53	-2.49	0.00	0.00	0.00	8.91
30	3	30	40.60	-9.22	0.00	0.00	0.00	-8.91
		31	-40.68	9.29	0.00	0.00	0.00	-3.68
31	3	31	41.50	-4.40	0.00	0.00	0.00	3.68
		32	-41.58	4.46	0.00	0.00	0.00	-9.74
32	3	32	41.82	0.05	0.00	0.00	0.00	9.74
		33	-41.91	0.00	0.00	0.00	0.00	-9.71
33	3	33	41.64	4.81	0.00	0.00	0.00	9.71
		34	-41.73	-4.77	0.00	0.00	0.00	-3.19
34	3	34	40.97	9.28	0.00	0.00	0.00	3.19
		35	-41.07	-9.25	0.00	0.00	0.00	9.45
35	3	35	36.36	-6.05	0.00	0.00	0.00	-9.45
		36	-36.47	6.06	0.00	0.00	0.00	1.16

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	36.93	-1.75	0.00	0.00	0.00	-1.16
		37	-37.03	1.76	0.00	0.00	0.00	-1.23
37	3	37	36.99	-2.52	0.00	0.00	0.00	-1.23
		38	-37.11	2.53	0.00	0.00	0.00	-2.71
38	3	38	36.48	-7.26	0.00	0.00	0.00	2.71
		39	-36.60	7.28	0.00	0.00	0.00	-14.12
39	3	39	44.18	14.73	0.00	0.00	0.00	14.12
		40	-44.30	-14.69	0.00	0.00	0.00	8.82
40	3	40	45.82	8.84	0.00	0.00	0.00	-8.82
		41	-45.93	-8.79	0.00	0.00	0.00	22.62
41	3	41	46.69	2.69	0.00	0.00	0.00	-22.62
		42	-46.79	-2.62	0.00	0.00	0.00	26.79
42	3	42	46.82	-2.02	0.00	0.00	0.00	-26.79
		43	-46.87	2.06	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

49. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.730	3
		46.80 C	0.00	26.81	0.87
4	ST W8X 31	PASS	AISC- H1-2	0.729	3
		46.76 C	0.00	-26.81	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.642	3
		45.92 C	0.00	-22.31	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.481	3
		44.26 C	0.00	-13.97	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.442	3
		36.59 C	0.00	13.97	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.235	3
		37.11 C	0.00	2.54	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.214	3
		37.02 C	0.00	1.43	0.00
10	ST W8X 31	PASS	AISC- H1-2	0.360	3
		36.37 C	0.00	9.57	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.384	3
		40.99 C	0.00	-9.57	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.385	3
		41.65 C	0.00	-9.48	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.392	3
		41.80 C	0.00	-9.83	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.391	3
		41.56 C	0.00	9.83	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.370	3
		40.58 C	0.00	8.92	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.192	3
		5.53 C	0.00	-8.92	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.130	3
		5.71 C	0.00	-5.45	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.080	3
		5.85 C	0.00	-2.73	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.045	3
		5.92 C	0.00	-0.78	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.046	3
		5.92 C	0.00	-0.83	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.046	3
		5.92 C	0.00	0.83	0.00
22	ST W8X 31	PASS	AISC- H1-3	0.046	3
		5.78 C	0.00	-0.88	1.37
23	ST W8X 31	PASS	AISC- H1-3	0.046	3
		5.78 C	0.00	0.88	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.046	3
		5.92 C	0.00	-0.83	1.36
25	ST W8X 31	PASS	AISC- H1-3	0.046	3
		5.92 C	0.00	0.83	0.00
26	ST W8X 31	PASS	AISC- H1-3	0.045	3
		5.93 C	0.00	0.76	1.37

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.080	3
		5.84 C	0.00	2.73	1.36
28	ST W8X 31	PASS	AISC- H1-3	0.130	3
		5.71 C	0.00	5.45	1.36
29	ST W8X 31	PASS	AISC- H1-3	0.192	3
		5.53 C	0.00	8.91	1.37
30	ST W8X 31	PASS	AISC- H1-2	0.370	3
		40.60 C	0.00	-8.91	0.00
31	ST W8X 31	PASS	AISC- H1-2	0.390	3
		41.58 C	0.00	-9.74	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.391	3
		41.82 C	0.00	9.74	0.00
33	ST W8X 31	PASS	AISC- H1-2	0.389	3
		41.64 C	0.00	9.71	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.382	3
		41.07 C	0.00	9.45	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.358	3
		36.36 C	0.00	-9.45	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.210	3
		37.03 C	0.00	-1.23	1.36
37	ST W8X 31	PASS	AISC- H1-2	0.238	3
		37.11 C	0.00	-2.71	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.445	3
		36.60 C	0.00	-14.12	1.57
39	ST W8X 31	PASS	AISC- H1-2	0.483	3
		44.18 C	0.00	14.12	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.648	3
		45.93 C	0.00	22.62	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.729	3
		46.79 C	0.00	26.79	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.729	3
		46.82 C	0.00	-26.79	0.00

************** END OF TABULATED RESULT OF DESIGN **************

50. PLOT DISPLACEMENT FILE
51. PLOT BENDING FILE
52. FINISH

*************** END OF STAAD-III ***************

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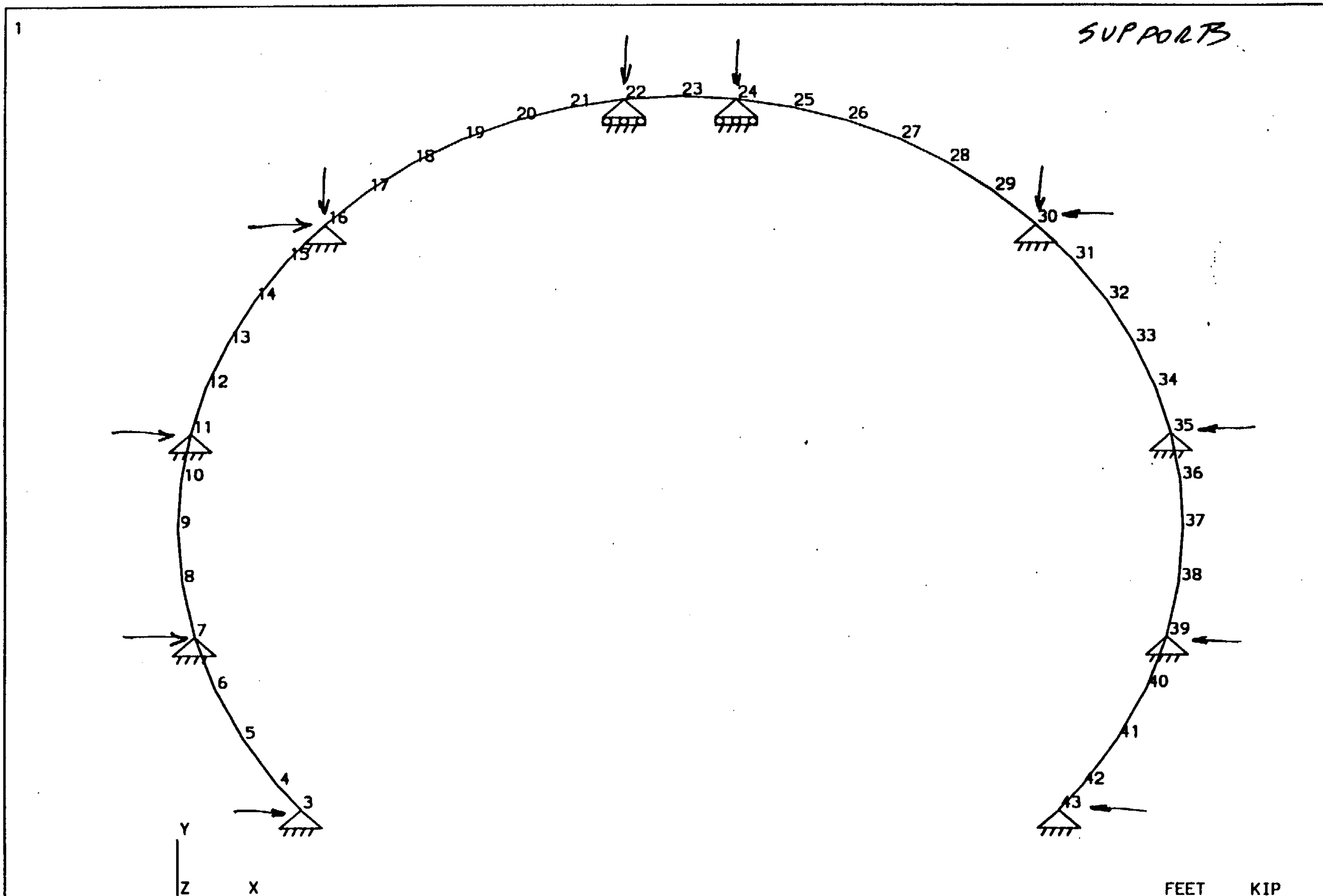

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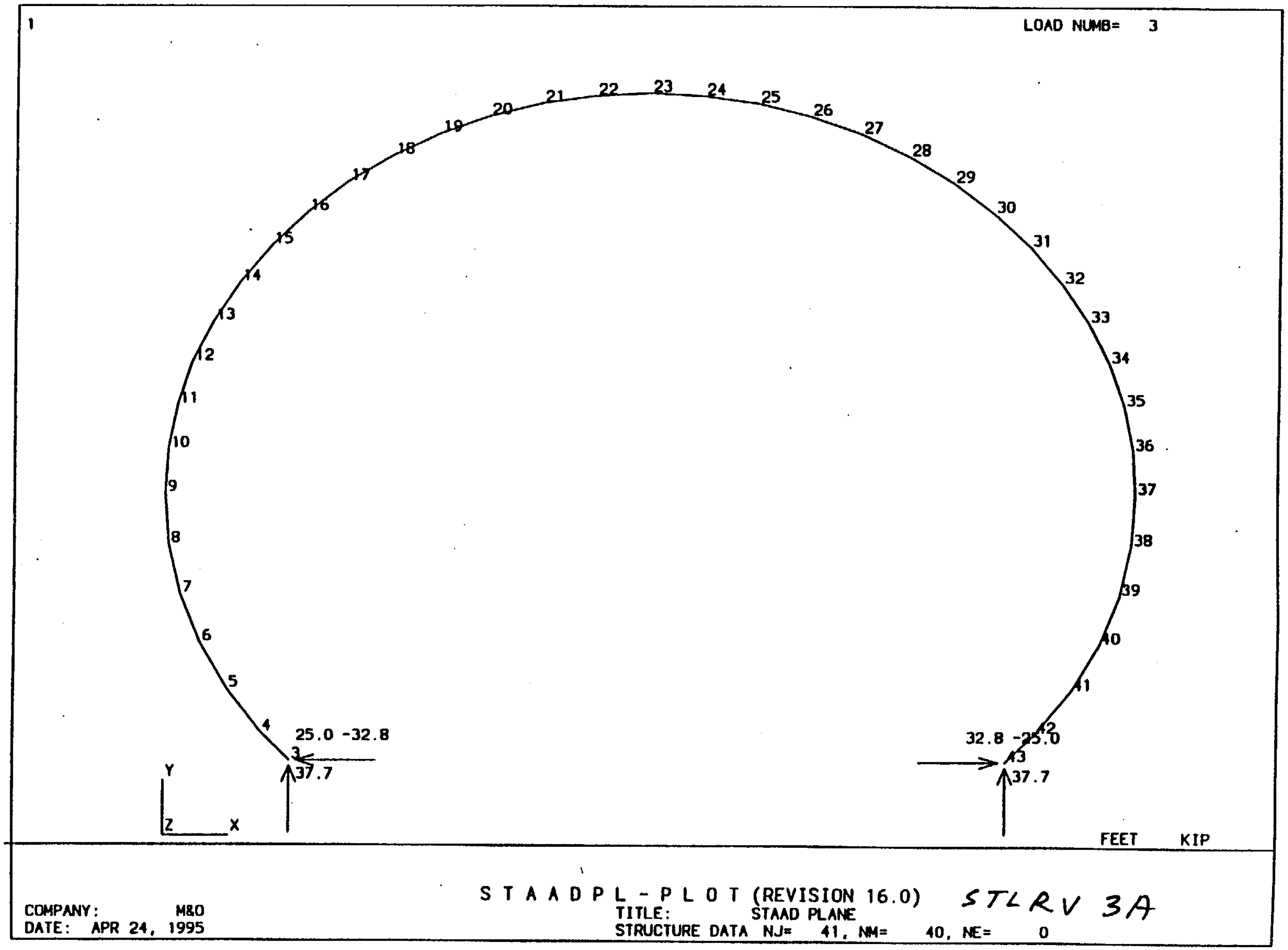
COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0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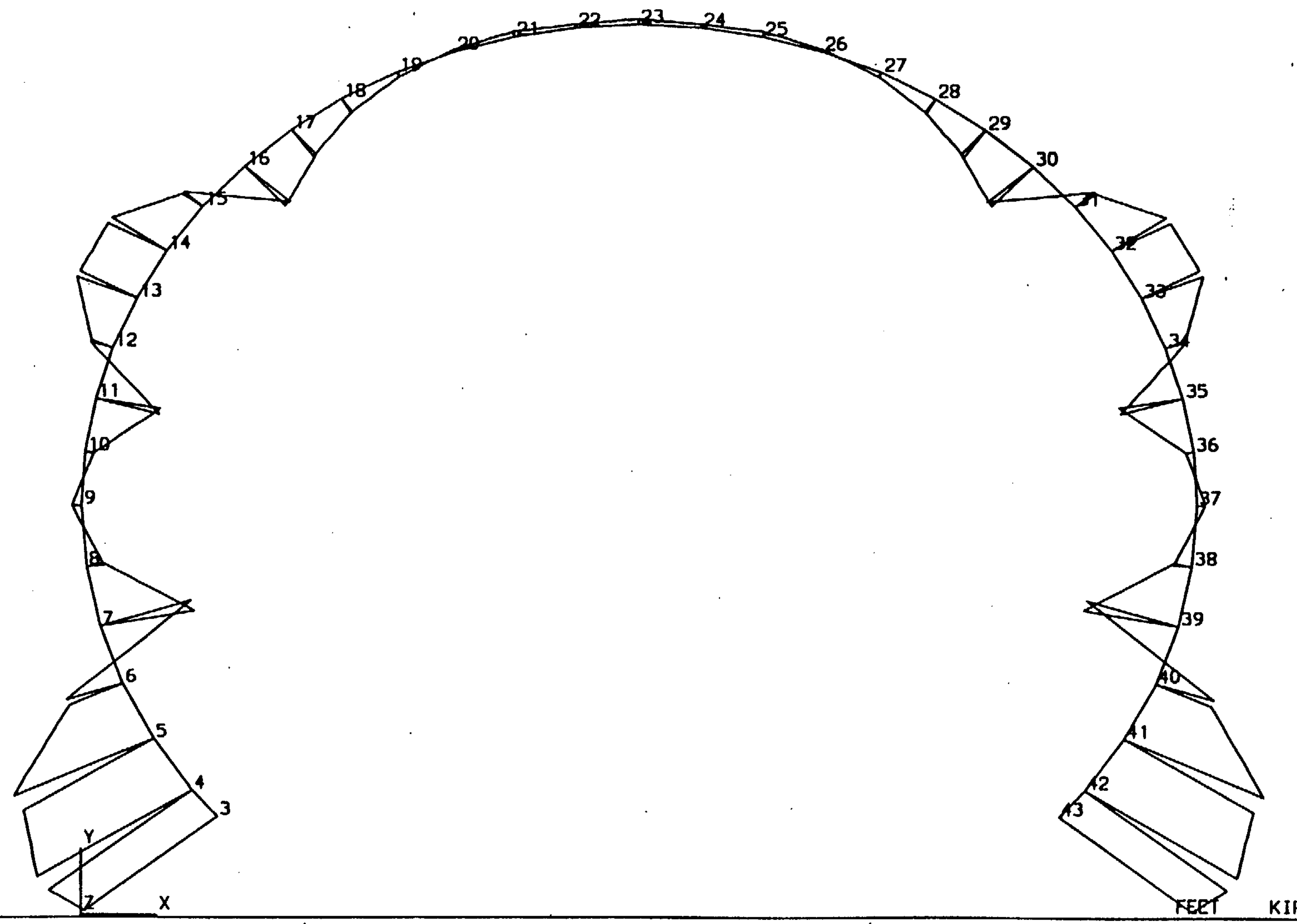
37.7
32.8 -25.0
37.7
Y
Z
X
FEET KIP
STAADPL-PLOT (REVISION 16.0)
STLRV 3A
COMPANY: M&O
DATE: APR 24, 1995
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

1

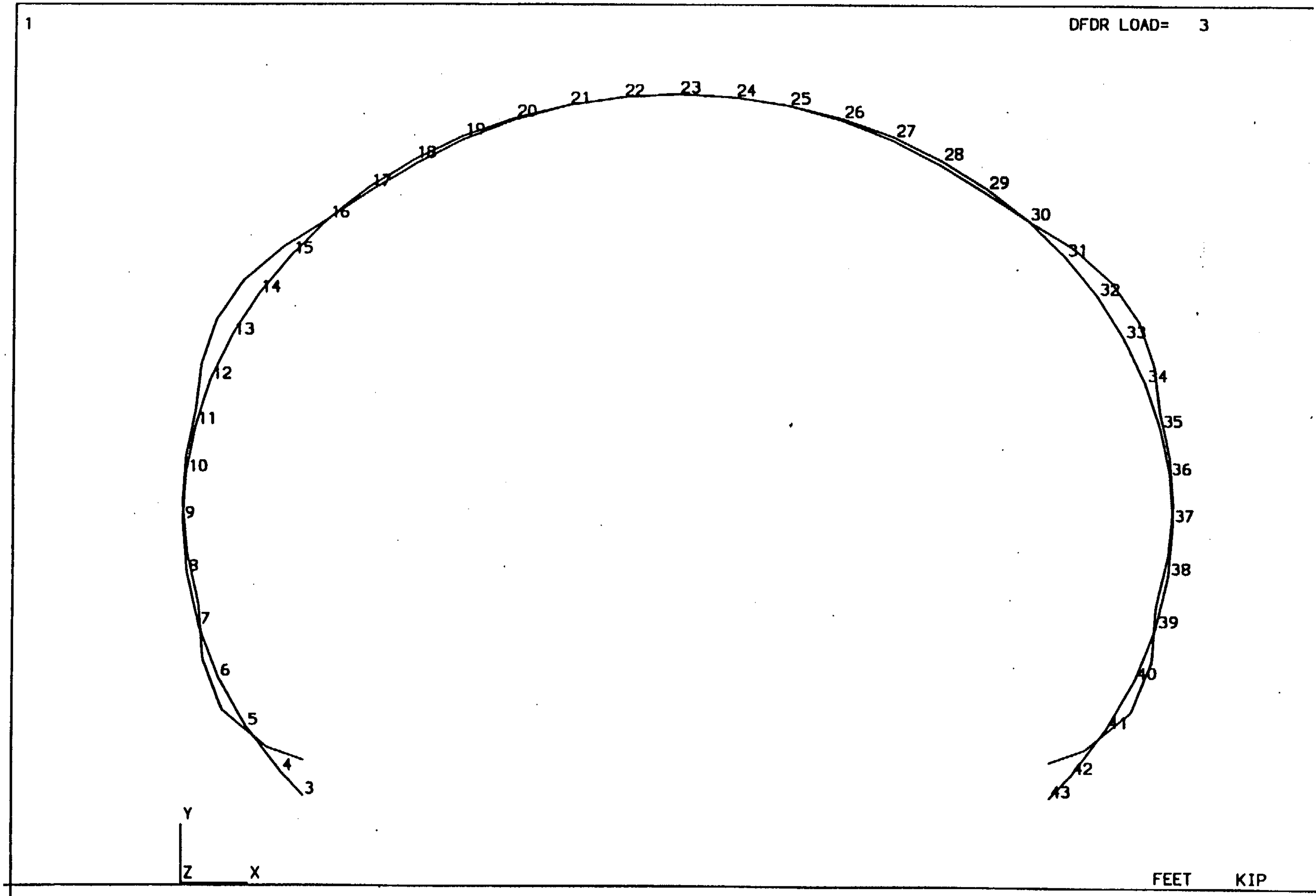
MOMENT MZ LN= 3



STAADPL-PLOT (REVISION 16.0) STLRV 3A

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0



S T A A D P L - P L O T (REVISION 16.0) STZRV 3A

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

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**************************************************
*                                                *
*              S T A A D - III                   *
*              Revision 16.0b                    *
*              Proprietary Program of            *
*              RESEARCH ENGINEERS, Inc.          *
*              Date=    JUL 18, 1995             *
*              Time=     9: 1:57                 *
*                                                *
**************************************************
```

```
STAAD PLANE BABEE0000-01717-0200-00003  ATTACHMENT  I
* ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
* FILE STLRV3D
* 25 TON JACKS APPLIED BOTH SIDES @ 51 DEGREES
UNIT FT KIP
JOINT COORDINATES
3 2.71 2.77 ; 4 2.43 3.13
5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.62 2.77
MEMBER INCIDENCE
3 3 4 42
UNIT KIP INCH
MEMBER PROPERTIES
3 TO 42 TA STA W8X31
CONSTANTS
E 29000.0 ALL
DENSITY 0.00028 ALL
BETA 0 ALL
UNIT FT
SUPPORT
3 7 11 35 39 43 FIXED BUT FY MZ
22 24 FIXED BUT FX MZ
16 30 PINNED
UNIT KIP
LOAD 1
SELF WEIGHT Y -1.0
LOADING 2
* 25 TON JACKS & SIMULTANEOUS JACKING
JOINT LOADING
3 FX -31.47
43 FX 31.47
3 43 FY 38.86
43 MZ -25.00
3 MZ 25.00
LOADING COMBINATION 3
1 2.5 2 1.0
```

```
        P R O B L E M   S T A T I S T I C S
        -----------------------------------

    NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     41/    40/    10
    ORIGINAL/FINAL BAND-WIDTH =      1/     1
    TOTAL PRIMARY LOAD CASES  =      2, TOTAL DEGREES OF FREEDOM =     111
    SIZE OF STIFFNESS MATRIX =       666 DOUBLE PREC. WORDS
    TOTAL REQUIRED DISK SPACE =      0.07 MEGA-BYTES

 ++ PROCESSING ELEMENT STIFFNESS MATRIX.                      9: 2: 0
 ++ PROCESSING GLOBAL STIFFNESS MATRIX.                       9: 2: 1
 ++ PROCESSING TRIANGULAR FACTORIZATION.                      9: 2: 1
 ++ CALCULATING JOINT DISPLACEMENTS.                          9: 2: 1
 ++ CALCULATING MEMBER  FORCES.                               9: 2: 2

   46. LOAD LIST 3
   47. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.05793	0.00000	0.00000	0.00000	0.00273
4	3	-0.01029	0.04868	0.00000	0.00000	0.00000	0.00220
5	3	-0.02835	0.03294	0.00000	0.00000	0.00000	0.00051
6	3	-0.02052	0.03302	0.00000	0.00000	0.00000	-0.00060
7	3	0.00000	0.03655	0.00000	0.00000	0.00000	-0.00048
8	3	-0.00054	0.03372	0.00000	0.00000	0.00000	0.00003
9	3	-0.00238	0.03088	0.00000	0.00000	0.00000	0.00001
10	3	-0.00098	0.02845	0.00000	0.00000	0.00000	-0.00002
11	3	0.00000	0.02592	0.00000	0.00000	0.00000	0.00034
12	3	-0.01348	0.02702	0.00000	0.00000	0.00000	0.00055
13	3	-0.02249	0.02792	0.00000	0.00000	0.00000	0.00016
14	3	-0.02186	0.02454	0.00000	0.00000	0.00000	-0.00045
15	3	-0.01221	0.01448	0.00000	0.00000	0.00000	-0.00088
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00071
17	3	0.00401	-0.00501	0.00000	0.00000	0.00000	-0.00026
18	3	0.00424	-0.00596	0.00000	0.00000	0.00000	0.00000
19	3	0.00307	-0.00459	0.00000	0.00000	0.00000	0.00011
20	3	0.00180	-0.00249	0.00000	0.00000	0.00000	0.00012
21	3	0.00092	-0.00080	0.00000	0.00000	0.00000	0.00008
22	3	0.00040	0.00000	0.00000	0.00000	0.00000	0.00004
23	3	0.00001	0.00051	0.00000	0.00000	0.00000	0.00000
24	3	-0.00039	0.00000	0.00000	0.00000	0.00000	-0.00004
25	3	-0.00090	-0.00079	0.00000	0.00000	0.00000	-0.00008
26	3	-0.00178	-0.00247	0.00000	0.00000	0.00000	-0.00012
27	3	-0.00304	-0.00457	0.00000	0.00000	0.00000	-0.00011
28	3	-0.00422	-0.00593	0.00000	0.00000	0.00000	0.00000
29	3	-0.00400	-0.00500	0.00000	0.00000	0.00000	0.00026
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00071
31	3	0.01219	0.01446	0.00000	0.00000	0.00000	0.00088
32	3	0.02184	0.02453	0.00000	0.00000	0.00000	0.00045
33	3	0.02259	0.02799	0.00000	0.00000	0.00000	-0.00016
34	3	0.01337	0.02706	0.00000	0.00000	0.00000	-0.00055
35	3	0.00000	0.02591	0.00000	0.00000	0.00000	-0.00034
36	3	0.00094	0.02843	0.00000	0.00000	0.00000	0.00001
37	3	0.00209	0.03085	0.00000	0.00000	0.00000	-0.00001
38	3	0.00028	0.03367	0.00000	0.00000	0.00000	-0.00002
39	3	0.00000	0.03646	0.00000	0.00000	0.00000	0.00050
40	3	0.02099	0.03289	0.00000	0.00000	0.00000	0.00062
41	3	0.02886	0.03279	0.00000	0.00000	0.00000	-0.00052
42	3	0.01040	0.04896	0.00000	0.00000	0.00000	-0.00223
43	3	0.00000	0.05830	0.00000	0.00000	0.00000	-0.00275

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	3.59	0.00	0.00	0.00	0.00	0.00
7	3	27.72	0.00	0.00	0.00	0.00	0.00
11	3	21.16	0.00	0.00	0.00	0.00	0.00
35	3	-21.23	0.00	0.00	0.00	0.00	0.00
39	3	-27.72	0.00	0.00	0.00	0.00	0.00
43	3	-3.56	0.00	0.00	0.00	0.00	0.00
22	3	0.00	-1.11	0.00	0.00	0.00	0.00
24	3	0.00	-1.12	0.00	0.00	0.00	0.00
16	3	-15.09	-35.64	0.00	0.00	0.00	0.00
30	3	15.13	-35.64	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	47.79	1.85	0.00	0.00	0.00	-25.00
		4	-47.77	-1.83	0.00	0.00	0.00	25.84
4	3	4	47.75	-2.26	0.00	0.00	0.00	-25.84
		5	-47.65	2.32	0.00	0.00	0.00	22.26
5	3	5	46.98	-8.30	0.00	0.00	0.00	-22.26
		6	-46.87	8.35	0.00	0.00	0.00	9.22
6	3	6	45.48	-14.07	0.00	0.00	0.00	-9.22
		7	-45.37	14.11	0.00	0.00	0.00	-12.78
7	3	7	37.79	7.19	0.00	0.00	0.00	12.78
		8	-37.67	-7.17	0.00	0.00	0.00	-1.52
8	3	8	38.28	2.29	0.00	0.00	0.00	1.52
		9	-38.16	-2.28	0.00	0.00	0.00	2.05
9	3	9	38.15	2.41	0.00	0.00	0.00	2.05
		10	-38.05	-2.41	0.00	0.00	0.00	1.24
10	3	10	37.55	6.57	0.00	0.00	0.00	-1.24
		11	-37.45	-6.55	0.00	0.00	0.00	10.22
11	3	11	42.29	-9.87	0.00	0.00	0.00	-10.22
		12	-42.19	9.90	0.00	0.00	0.00	-3.24
12	3	12	43.09	-4.65	0.00	0.00	0.00	3.24
		13	-42.99	4.69	0.00	0.00	0.00	-9.63
13	3	13	43.24	-0.30	0.00	0.00	0.00	9.63
		14	-43.15	0.35	0.00	0.00	0.00	-10.07
14	3	14	42.91	4.58	0.00	0.00	0.00	10.07
		15	-42.82	-4.51	0.00	0.00	0.00	-3.84
15	3	15	41.99	9.57	0.00	0.00	0.00	3.84
		16	-41.91	-9.50	0.00	0.00	0.00	9.12
16	3	16	5.64	-2.55	0.00	0.00	0.00	-9.12
		17	-5.57	2.63	0.00	0.00	0.00	5.58
17	3	17	5.82	-2.00	0.00	0.00	0.00	-5.58
		18	-5.76	2.09	0.00	0.00	0.00	2.79
18	3	18	5.97	-1.41	0.00	0.00	0.00	-2.79
		19	-5.92	1.50	0.00	0.00	0.00	0.79

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	6.05	-0.84	0.00	0.00	0.00	-0.79
		20	-6.01	0.93	0.00	0.00	0.00	-0.41
20	3	20	6.07	-0.27	0.00	0.00	0.00	0.41
		21	-6.04	0.37	0.00	0.00	0.00	-0.85
21	3	21	6.05	0.31	0.00	0.00	0.00	0.85
		22	-6.03	-0.20	0.00	0.00	0.00	-0.50
22	3	22	5.90	-0.24	0.00	0.00	0.00	0.50
		23	-5.90	0.34	0.00	0.00	0.00	-0.90
23	3	23	5.90	0.35	0.00	0.00	0.00	0.90
		24	-5.90	-0.24	0.00	0.00	0.00	-0.50
24	3	24	6.03	-0.21	0.00	0.00	0.00	0.50
		25	-6.05	0.31	0.00	0.00	0.00	-0.85
25	3	25	6.04	0.37	0.00	0.00	0.00	0.85
		26	-6.07	-0.27	0.00	0.00	0.00	-0.41
26	3	26	6.01	0.91	0.00	0.00	0.00	0.41
		27	-6.05	-0.82	0.00	0.00	0.00	0.78
27	3	27	5.91	1.52	0.00	0.00	0.00	-0.78
		28	-5.96	-1.43	0.00	0.00	0.00	2.79
28	3	28	5.77	2.09	0.00	0.00	0.00	-2.79
		29	-5.83	-2.00	0.00	0.00	0.00	5.57
29	3	29	5.57	2.63	0.00	0.00	0.00	-5.57
		30	-5.64	-2.55	0.00	0.00	0.00	9.12
30	3	30	41.94	-9.47	0.00	0.00	0.00	-9.12
		31	-42.02	9.54	0.00	0.00	0.00	-3.80
31	3	31	42.85	-4.48	0.00	0.00	0.00	3.80
		32	-42.94	4.54	0.00	0.00	0.00	-9.98
32	3	32	43.18	0.11	0.00	0.00	0.00	9.98
		33	-43.27	-0.06	0.00	0.00	0.00	-9.86
33	3	33	42.97	5.03	0.00	0.00	0.00	9.86
		34	-43.07	-4.99	0.00	0.00	0.00	-3.04
34	3	34	42.27	9.65	0.00	0.00	0.00	3.04
		35	-42.37	-9.62	0.00	0.00	0.00	10.10
35	3	35	37.44	-6.57	0.00	0.00	0.00	-10.10
		36	-37.55	6.59	0.00	0.00	0.00	1.09

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	38.06	-2.15	0.00	0.00	0.00	-1.09
		37	-38.16	2.15	0.00	0.00	0.00	-1.84
37	3	37	38.16	-2.26	0.00	0.00	0.00	-1.84
		38	-38.28	2.26	0.00	0.00	0.00	-1.69
38	3	38	37.67	-7.15	0.00	0.00	0.00	1.69
		39	-37.79	7.17	0.00	0.00	0.00	-12.92
39	3	39	45.29	14.41	0.00	0.00	0.00	12.92
		40	-45.40	-14.37	0.00	0.00	0.00	9.52
40	3	40	46.88	8.38	0.00	0.00	0.00	-9.52
		41	-46.99	-8.33	0.00	0.00	0.00	22.60
41	3	41	47.67	2.09	0.00	0.00	0.00	-22.60
		42	-47.78	-2.03	0.00	0.00	0.00	25.83
42	3	42	47.78	-1.80	0.00	0.00	0.00	-25.83
		43	-47.81	1.82	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

48. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.717	3
		47.77 C	0.00	25.84	0.46
4	ST W8X 31	PASS	AISC- H1-2	0.717	3
		47.75 C	0.00	-25.84	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.647	3
		46.98 C	0.00	-22.26	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.465	3
		45.37 C	0.00	-12.78	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.426	3
		37.79 C	0.00	12.78	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.231	3
		38.16 C	0.00	2.05	1.56
9	ST W8X 31	PASS	AISC- H1-2	0.231	3
		38.15 C	0.00	2.05	0.00
10	ST W8X 31	PASS	AISC- H1-2	0.378	3
		37.45 C	0.00	10.22	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.402	3
		42.29 C	0.00	-10.22	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.395	3
		42.99 C	0.00	-9.63	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.404	3
		43.15 C	0.00	-10.07	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.403	3
		42.91 C	0.00	10.07	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.380	3
		41.91 C	0.00	9.12	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.197	3
		5.64 C	0.00	-9.12	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.132	3
		5.82 C	0.00	-5.58	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.082	3
		5.97 C	0.00	-2.79	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.046	3
		6.05 C	0.00	-0.79	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.047	3
		6.04 C	0.00	-0.85	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.047	3
		6.05 C	0.00	0.85	0.00
22	ST W8X 31	PASS	AISC- H1-3	0.047	3
		5.90 C	0.00	-0.90	1.37
23	ST W8X 31	PASS	AISC- H1-3	0.047	3
		5.90 C	0.00	0.90	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.047	3
		6.05 C	0.00	-0.85	1.36
25	ST W8X 31	PASS	AISC- H1-3	0.047	3
		6.04 C	0.00	0.85	0.00
26	ST W8X 31	PASS	AISC- H1-3	0.046	3
		6.05 C	0.00	0.78	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.082	3
		5.96 C	0.00	2.79	1.36
28	ST W8X 31	PASS	AISC- H1-3	0.132	3
		5.83 C	0.00	5.57	1.36
29	ST W8X 31	PASS	AISC- H1-3	0.196	3
		5.64 C	0.00	9.12	1.37
30	ST W8X 31	PASS	AISC- H1-2	0.380	3
		41.94 C	0.00	-9.12	0.00
31	ST W8X 31	PASS	AISC- H1-2	0.401	3
		42.94 C	0.00	-9.98	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.402	3
		43.18 C	0.00	9.98	0.00
33	ST W8X 31	PASS	AISC- H1-2	0.399	3
		42.97 C	0.00	9.86	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.400	3
		42.37 C	0.00	10.10	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.375	3
		37.44 C	0.00	-10.10	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.227	3
		38.16 C	0.00	-1.84	1.36
37	ST W8X 31	PASS	AISC- H1-2	0.227	3
		38.16 C	0.00	-1.84	0.00
38	ST W8X 31	PASS	AISC- H1-2	0.429	3
		37.79 C	0.00	-12.92	1.57
39	ST W8X 31	PASS	AISC- H1-2	0.467	3
		45.29 C	0.00	12.92	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.653	3
		46.99 C	0.00	22.60	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.717	3
		47.78 C	0.00	25.83	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.717	3
		47.78 C	0.00	-25.83	0.00

************** END OF TABULATED RESULT OF DESIGN **************

49. PLOT DISPLACEMENT FILE
50. PLOT BENDING FILE
51. FINISH

*************** END OF STAAD-III ***************

DATE= JUL 18,1995 TIME= 9: 2: 5 ******

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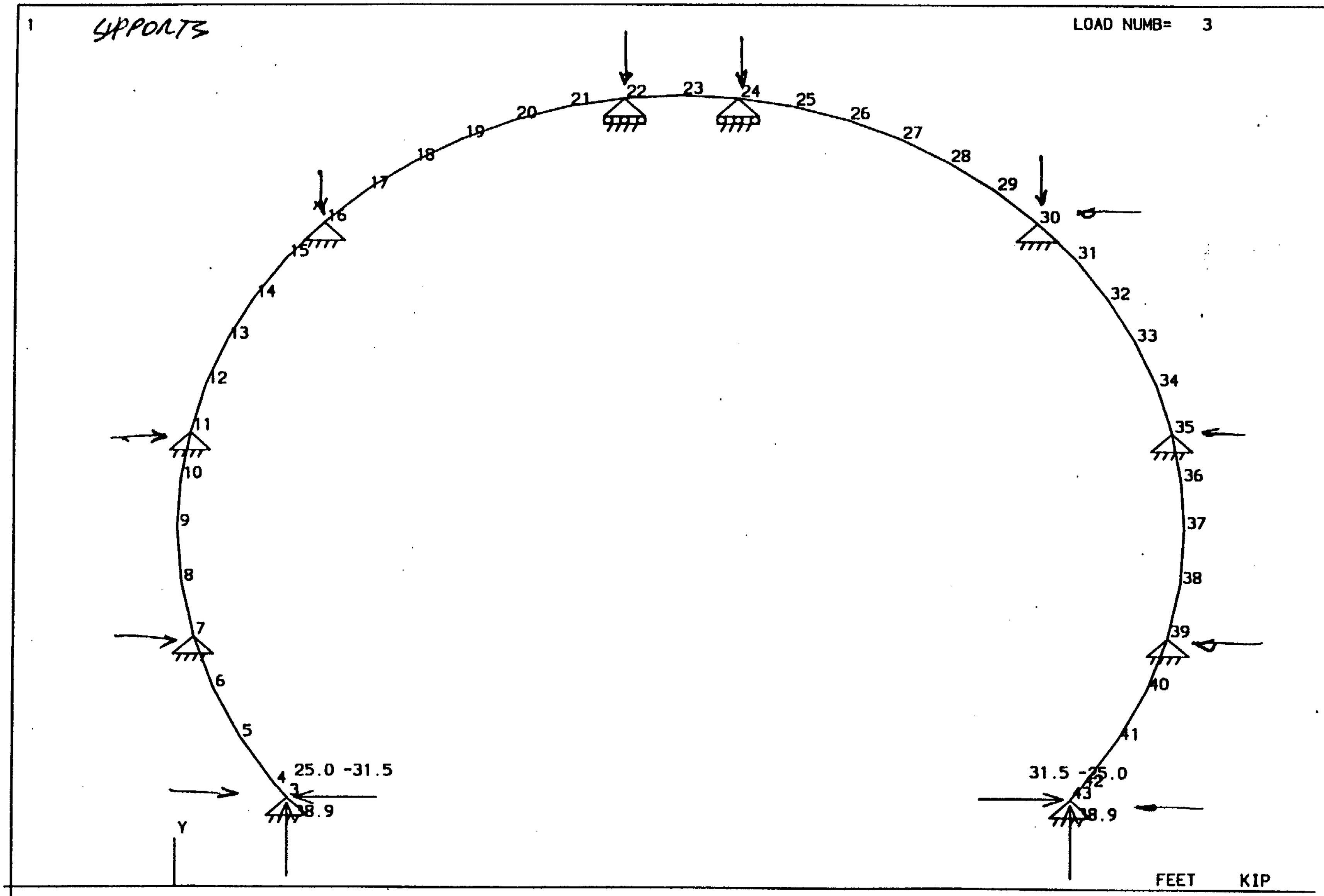
**********************************************************
*       For questions on STAAD-III/ISDS, contact:        *
*       RESEARCH ENGINEERS, Inc at (714) 974-2500        *
```



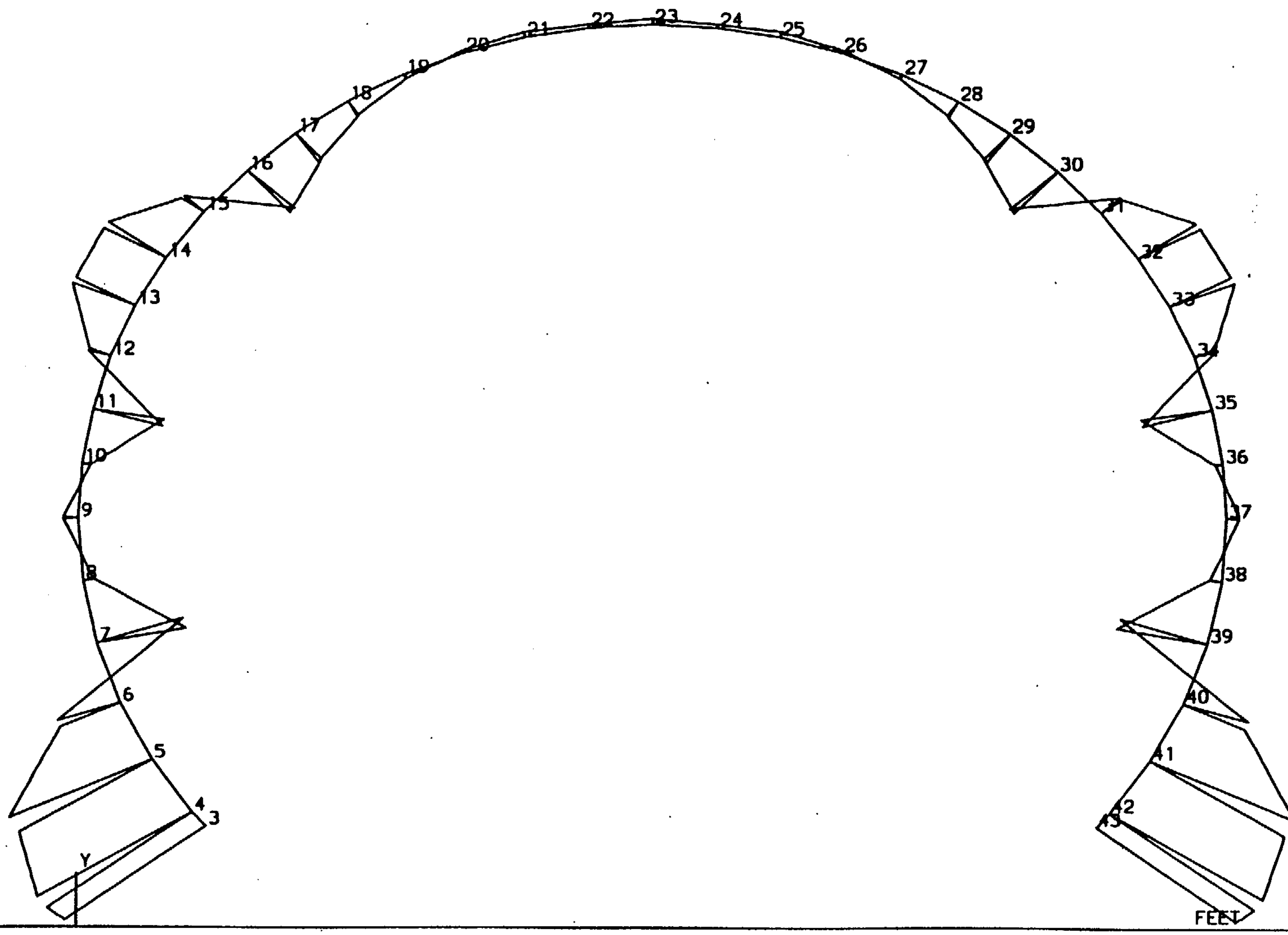
S T A A D P L - P L O T (REVISION 16.0) STL RV 3D

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

1

MOMENT MZ LN= 3



S T A A D P L - P L O T (REVISION 16.0) STZRV 3D

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

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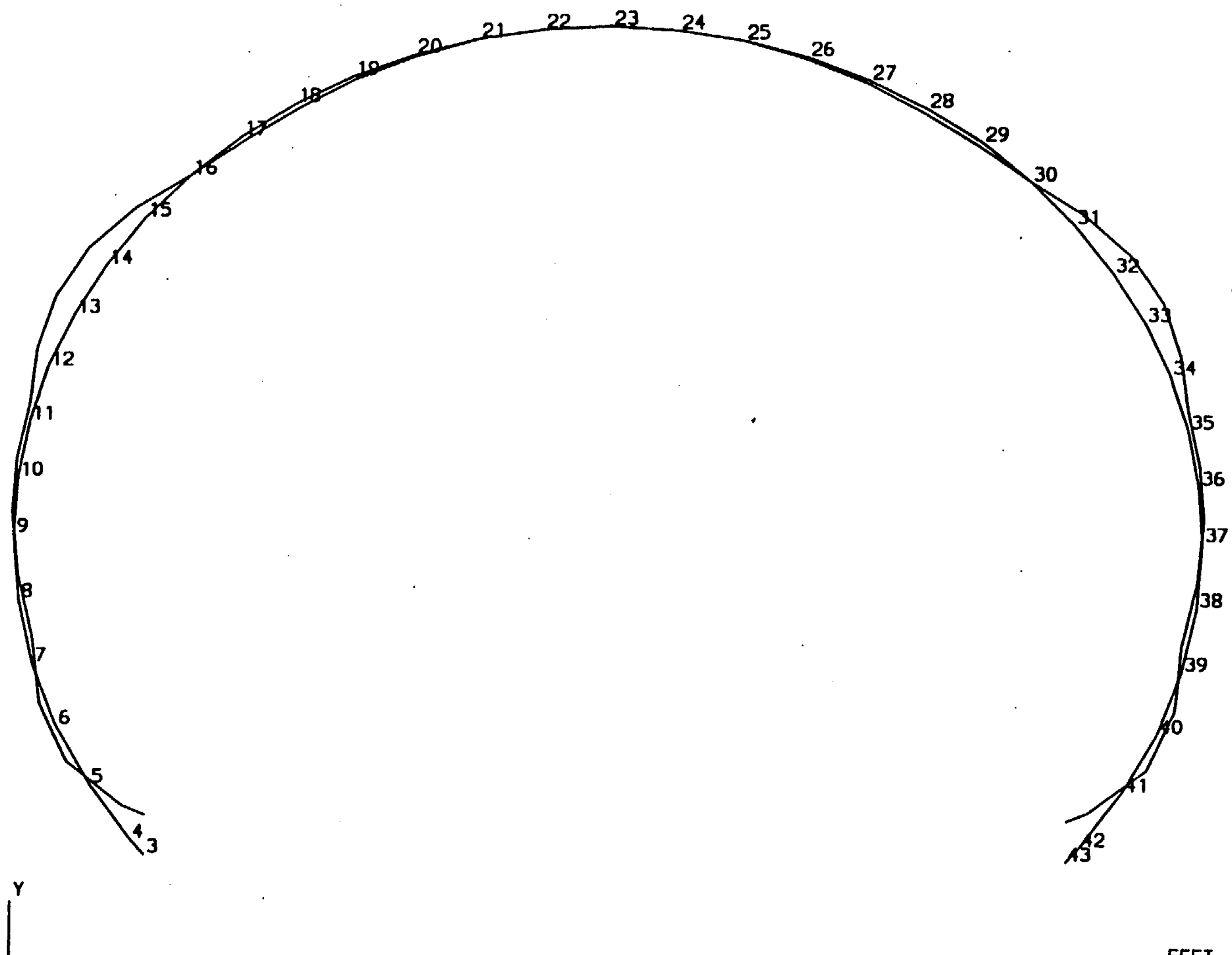
DFDR LOAD= 3



FEET KIP

COMPANY: M&O
DATE: JUL 18, 1995

S T A A D P L - P L O T (REVISION 16.0) STLRV 3D
TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

```
****************************************************
*                                                  *
*              S T A A D - III                     *
*              Revision 16.0b                      *
*              Proprietary Program of              *
*              RESEARCH ENGINEERS, Inc.            *
*              Date=    JUL 18, 1995               *
*              Time=    10:10:59                   *
*                                                  *
****************************************************
```

```
 1. STAAD PLANE  BABEE0000-01717-0200-00003 ATTACHMENT  I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. * FILE STLRV3B
 4. * 25 TON JACKS APPLIED BOTH SIDES @ 47 DEGREES
 5. * MOMENT MZ RELEASED AT THE ENDS OF MEMBERS 15 AND 29
 6. * MOMENT MZ RELEASED AT THE START OF MEMBERS 16 AND 30
 7. UNIT FT KIP
 8. JOINT COORDINATES
 9. 3 3.27 2.13 ; 4 2.43 3.13
10. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
11. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
12. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
13. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39; 20 8.15 21.91
14. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
15. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
16. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
17. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
18. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
19. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.06 2.13
20. MEMBER INCIDENCE
21. 3 3 4 42
22. UNIT KIP INCH
23. MEMBER RELEASE
24. 15 29 END MZ
25. 16 30 START MZ
26. MEMBER PROPERTIES
27. 3 TO 42 TA STA W8X31
28. CONSTANTS
29. E 29000.0 ALL
30. DENSITY 0.00028 ALL
31. BETA 0 ALL
32. UNIT FT
33. SUPPORT
34. 3 7 11 35 39 43 FIXED BUT FY MZ
35. 22 24 FIXED BUT FX MZ
36. 16 30 PINNED
37. UNIT KIP
38. LOAD 1
39. SELF WEIGHT Y -1.0
40. LOADING 2
41. * 25 TON JACKS & SIMULTANEOUS JACKING
42. JOINT LOADING
43. 3 FX -34.10
44. 43 FX 34.10
45. 3 FY 36.57
46. 43 FY 36.57
47. 43 MZ -25.00
```

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48. 3 MZ 25.00
49. LOADING COMBINATION 3
50. 1 2.5 2 1.0
51. PERFORM ANALYSIS


        P R O B L E M   S T A T I S T I C S
        -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     41/    40/    10
  ORIGINAL/FINAL BAND-WIDTH =      1/     1
  TOTAL PRIMARY LOAD CASES  =      2, TOTAL DEGREES OF FREEDOM =    111
  SIZE OF STIFFNESS MATRIX =       666 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =      0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                    10:11: 2
++ PROCESSING GLOBAL STIFFNESS MATRIX.                     10:11: 3
++ PROCESSING TRIANGULAR FACTORIZATION.                    10:11: 3
++ CALCULATING JOINT DISPLACEMENTS.                        10:11: 3
++ CALCULATING MEMBER  FORCES.                             10:11: 4

52. LOAD LIST 3
53. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06910	0.00000	0.00000	0.00000	0.00342
4	3	-0.03097	0.03955	0.00000	0.00000	0.00000	0.00186
5	3	-0.04236	0.02831	0.00000	0.00000	0.00000	0.00008
6	3	-0.02702	0.03218	0.00000	0.00000	0.00000	-0.00100
7	3	0.00000	0.03808	0.00000	0.00000	0.00000	-0.00077
8	3	0.00352	0.03621	0.00000	0.00000	0.00000	-0.00011
9	3	0.00263	0.03360	0.00000	0.00000	0.00000	0.00003
10	3	0.00239	0.03141	0.00000	0.00000	0.00000	0.00013
11	3	0.00000	0.02960	0.00000	0.00000	0.00000	0.00056
12	3	-0.01765	0.03201	0.00000	0.00000	0.00000	0.00079
13	3	-0.03021	0.03454	0.00000	0.00000	0.00000	0.00030
14	3	-0.03095	0.03205	0.00000	0.00000	0.00000	-0.00050
15	3	-0.01909	0.02056	0.00000	0.00000	0.00000	-0.00127
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	3	0.00016	-0.00024	0.00000	0.00000	0.00000	-0.00001
18	3	0.00024	-0.00042	0.00000	0.00000	0.00000	-0.00001
19	3	0.00025	-0.00050	0.00000	0.00000	0.00000	0.00000
20	3	0.00019	-0.00043	0.00000	0.00000	0.00000	0.00001
21	3	0.00010	-0.00023	0.00000	0.00000	0.00000	0.00001
22	3	0.00003	0.00000	0.00000	0.00000	0.00000	0.00001
23	3	0.00000	0.00005	0.00000	0.00000	0.00000	0.00000
24	3	-0.00003	0.00000	0.00000	0.00000	0.00000	-0.00001
25	3	-0.00010	-0.00023	0.00000	0.00000	0.00000	-0.00001
26	3	-0.00019	-0.00043	0.00000	0.00000	0.00000	-0.00001
27	3	-0.00025	-0.00050	0.00000	0.00000	0.00000	0.00000
28	3	-0.00024	-0.00042	0.00000	0.00000	0.00000	0.00001
29	3	-0.00016	-0.00024	0.00000	0.00000	0.00000	0.00001
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
31	3	0.01907	0.02054	0.00000	0.00000	0.00000	0.00127
32	3	0.03093	0.03204	0.00000	0.00000	0.00000	0.00051
33	3	0.03030	0.03460	0.00000	0.00000	0.00000	-0.00030
34	3	0.01755	0.03208	0.00000	0.00000	0.00000	-0.00079
35	3	0.00000	0.02957	0.00000	0.00000	0.00000	-0.00056
36	3	-0.00244	0.03138	0.00000	0.00000	0.00000	-0.00014
37	3	-0.00291	0.03356	0.00000	0.00000	0.00000	-0.00004
38	3	-0.00377	0.03616	0.00000	0.00000	0.00000	0.00012
39	3	0.00000	0.03799	0.00000	0.00000	0.00000	0.00079
40	3	0.02749	0.03210	0.00000	0.00000	0.00000	0.00102
41	3	0.04292	0.02818	0.00000	0.00000	0.00000	-0.00009
42	3	0.03121	0.03975	0.00000	0.00000	0.00000	-0.00188
43	3	0.00000	0.06950	0.00000	0.00000	0.00000	-0.00344

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	6.37	0.00	0.00	0.00	0.00	0.00
7	3	27.80	0.00	0.00	0.00	0.00	0.00
11	3	21.31	0.00	0.00	0.00	0.00	0.00
35	3	-21.37	0.00	0.00	0.00	0.00	0.00
39	3	-27.81	0.00	0.00	0.00	0.00	0.00
43	3	-6.34	0.00	0.00	0.00	0.00	0.00
22	3	0.00	0.20	0.00	0.00	0.00	0.00
24	3	0.00	0.20	0.00	0.00	0.00	0.00
16	3	-20.92	-34.61	0.00	0.00	0.00	0.00
30	3	20.96	-34.61	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	45.84	2.29	0.00	0.00	0.00	-25.00
		4	-45.76	-2.22	0.00	0.00	0.00	27.95
4	3	4	45.69	-3.41	0.00	0.00	0.00	-27.95
		5	-45.59	3.48	0.00	0.00	0.00	22.57
5	3	5	44.79	-9.19	0.00	0.00	0.00	-22.57
		6	-44.68	9.24	0.00	0.00	0.00	8.15
6	3	6	43.20	-14.67	0.00	0.00	0.00	-8.15
		7	-43.09	14.71	0.00	0.00	0.00	-14.80
7	3	7	35.43	6.98	0.00	0.00	0.00	14.80
		8	-35.31	-6.95	0.00	0.00	0.00	-3.88
8	3	8	35.91	2.37	0.00	0.00	0.00	3.88
		9	-35.79	-2.37	0.00	0.00	0.00	-0.17
9	3	9	35.81	2.03	0.00	0.00	0.00	-0.17
		10	-35.71	-2.03	0.00	0.00	0.00	2.94
10	3	10	35.27	5.94	0.00	0.00	0.00	-2.94
		11	-35.17	-5.92	0.00	0.00	0.00	11.05
11	3	11	40.13	-10.89	0.00	0.00	0.00	-11.05
		12	-40.03	10.92	0.00	0.00	0.00	-3.79
12	3	12	41.07	-5.93	0.00	0.00	0.00	3.79
		13	-40.97	5.97	0.00	0.00	0.00	-11.92
13	3	13	41.36	-1.77	0.00	0.00	0.00	11.92
		14	-41.27	1.82	0.00	0.00	0.00	-14.35
14	3	14	41.21	2.90	0.00	0.00	0.00	14.35
		15	-41.13	-2.84	0.00	0.00	0.00	-10.42
15	3	15	40.50	7.70	0.00	0.00	0.00	10.42
		16	-40.42	-7.63	0.00	0.00	0.00	0.00
16	3	16	0.70	0.09	0.00	0.00	0.00	0.00
		17	-0.63	-0.01	0.00	0.00	0.00	0.07
17	3	17	0.62	0.08	0.00	0.00	0.00	-0.07
		18	-0.56	0.01	0.00	0.00	0.00	0.12
18	3	18	0.56	0.06	0.00	0.00	0.00	-0.12
		19	-0.51	0.03	0.00	0.00	0.00	0.13

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	0.51	0.02	0.00	0.00	0.00	-0.13
		20	-0.47	0.07	0.00	0.00	0.00	0.10
20	3	20	0.48	-0.02	0.00	0.00	0.00	-0.10
		21	-0.45	0.12	0.00	0.00	0.00	0.00
21	3	21	0.46	-0.07	0.00	0.00	0.00	0.00
		22	-0.44	0.17	0.00	0.00	0.00	-0.16
22	3	22	0.47	0.08	0.00	0.00	0.00	0.16
		23	-0.46	0.03	0.00	0.00	0.00	-0.13
23	3	23	0.46	0.03	0.00	0.00	0.00	0.13
		24	-0.47	0.08	0.00	0.00	0.00	-0.16
24	3	24	0.44	0.17	0.00	0.00	0.00	0.16
		25	-0.46	-0.07	0.00	0.00	0.00	0.00
25	3	25	0.45	0.12	0.00	0.00	0.00	0.00
		26	-0.48	-0.02	0.00	0.00	0.00	0.10
26	3	26	0.47	0.07	0.00	0.00	0.00	-0.10
		27	-0.51	0.03	0.00	0.00	0.00	0.13
27	3	27	0.51	0.03	0.00	0.00	0.00	-0.13
		28	-0.56	0.06	0.00	0.00	0.00	0.12
28	3	28	0.56	0.01	0.00	0.00	0.00	-0.12
		29	-0.62	0.08	0.00	0.00	0.00	0.07
29	3	29	0.63	-0.01	0.00	0.00	0.00	-0.07
		30	-0.70	0.09	0.00	0.00	0.00	0.00
30	3	30	40.45	-7.60	0.00	0.00	0.00	0.00
		31	-40.52	7.67	0.00	0.00	0.00	-10.38
31	3	31	41.15	-2.80	0.00	0.00	0.00	10.38
		32	-41.23	2.86	0.00	0.00	0.00	-14.27
32	3	32	41.30	1.59	0.00	0.00	0.00	14.27
		33	-41.39	-1.54	0.00	0.00	0.00	-12.13
33	3	33	40.94	6.28	0.00	0.00	0.00	12.13
		34	-41.04	-6.24	0.00	0.00	0.00	-3.60
34	3	34	40.12	10.67	0.00	0.00	0.00	3.60
		35	-40.22	-10.64	0.00	0.00	0.00	10.94
35	3	35	35.16	-5.93	0.00	0.00	0.00	-10.94
		36	-35.27	5.95	0.00	0.00	0.00	2.80

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	35.72	-1.78	0.00	0.00	0.00	-2.80
		37	-35.83	1.79	0.00	0.00	0.00	0.37
37	3	37	35.79	-2.35	0.00	0.00	0.00	0.37
		38	-35.91	2.36	0.00	0.00	0.00	-4.05
38	3	38	35.32	-6.94	0.00	0.00	0.00	4.05
		39	-35.43	6.96	0.00	0.00	0.00	-14.95
39	3	39	43.00	15.00	0.00	0.00	0.00	14.95
		40	-43.12	-14.96	0.00	0.00	0.00	8.41
40	3	40	44.69	9.26	0.00	0.00	0.00	-8.41
		41	-44.80	-9.21	0.00	0.00	0.00	22.87
41	3	41	45.62	3.26	0.00	0.00	0.00	-22.87
		42	-45.72	-3.19	0.00	0.00	0.00	27.92
42	3	42	45.78	-2.20	0.00	0.00	0.00	-27.92
		43	-45.86	2.27	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

54. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.745	3
		45.76 C	0.00	27.95	1.31
4	ST W8X 31	PASS	AISC- H1-2	0.745	3
		45.69 C	0.00	-27.95	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.642	3
		44.79 C	0.00	-22.57	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.490	3
		43.09 C	0.00	-14.80	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.452	3
		35.43 C	0.00	14.80	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.253	3
		35.91 C	0.00	3.88	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.235	3
		35.71 C	0.00	2.94	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.381	3
		35.17 C	0.00	11.05	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.407	3
		40.13 C	0.00	-11.05	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.427	3
		40.97 C	0.00	-11.92	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.473	3
		41.27 C	0.00	-14.35	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.473	3
		41.21 C	0.00	14.35	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.397	3
		40.50 C	0.00	10.42	0.00
16	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.63 C	0.00	0.07	1.37
17	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	0.12	1.36
18	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	-0.12	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	-0.13	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.48 C	0.00	-0.10	0.00
21	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.44 C	0.00	-0.16	1.36
22	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.47 C	0.00	0.16	0.00
23	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.47 C	0.00	-0.16	1.36
24	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.44 C	0.00	0.16	0.00
25	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.48 C	0.00	0.10	1.36
26	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	0.13	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

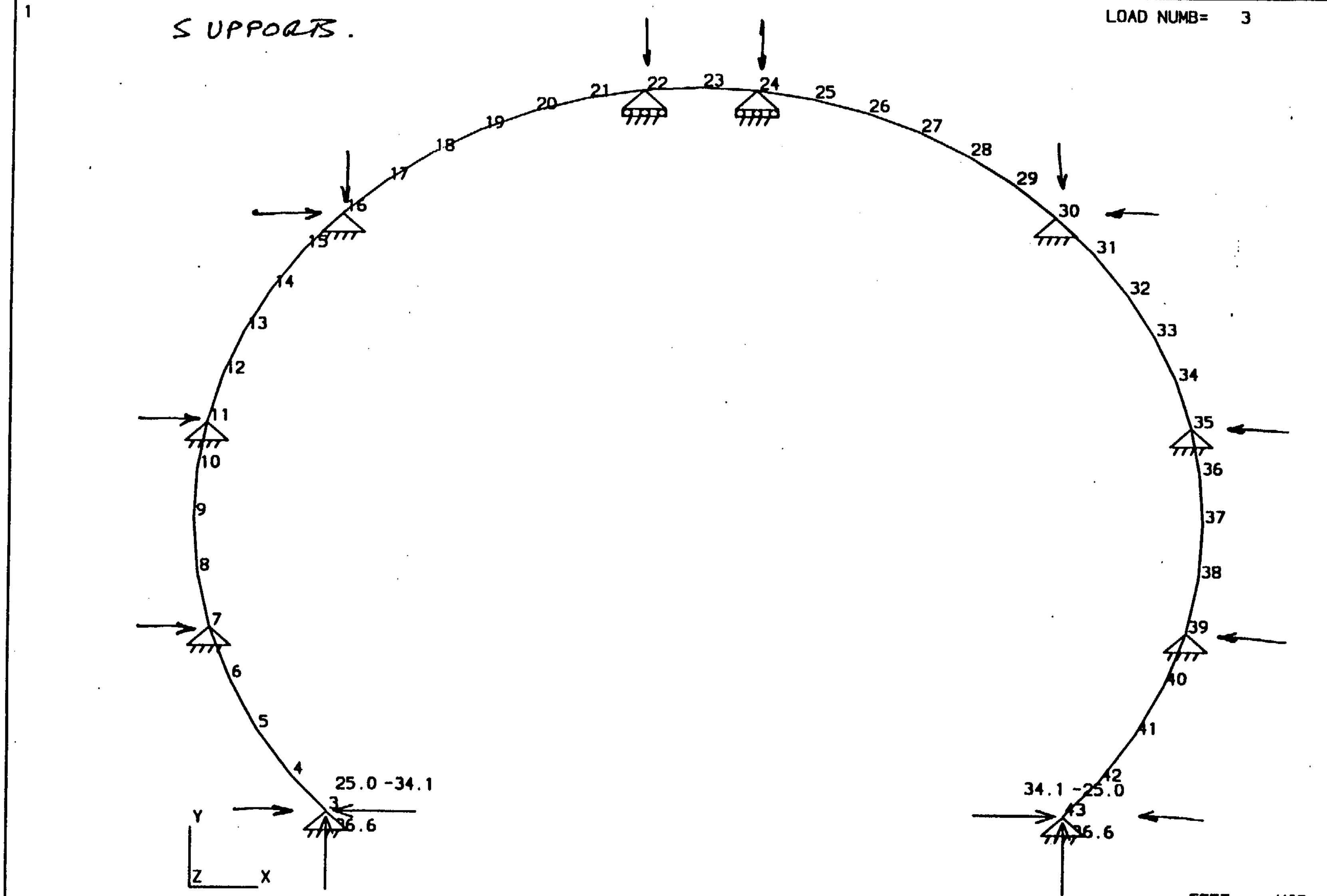
MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	-0.13	0.00
28	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	-0.12	0.00
29	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.63 C	0.00	-0.07	0.00
30	ST W8X 31	PASS	AISC- H1-2	0.396	3
		40.52 C	0.00	-10.38	1.36
31	ST W8X 31	PASS	AISC- H1-2	0.471	3
		41.23 C	0.00	-14.27	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.471	3
		41.30 C	0.00	14.27	0.00
33	ST W8X 31	PASS	AISC- H1-2	0.430	3
		40.94 C	0.00	12.13	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.405	3
		40.22 C	0.00	10.94	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.379	3
		35.16 C	0.00	-10.94	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.233	3
		35.72 C	0.00	-2.80	0.00
37	ST W8X 31	PASS	AISC- H1-2	0.256	3
		35.91 C	0.00	-4.05	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.454	3
		35.43 C	0.00	-14.95	1.57
39	ST W8X 31	PASS	AISC- H1-2	0.493	3
		43.00 C	0.00	14.95	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.647	3
		44.80 C	0.00	22.87	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.745	3
		45.72 C	0.00	27.92	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.745	3
		45.78 C	0.00	-27.92	0.00

************** END OF TABULATED RESULT OF DESIGN **************

55. PLOT DISPLACEMENT FILE
56. PLOT BENDING FILE
57. FINISH

*************** END OF STAAD-III ***************

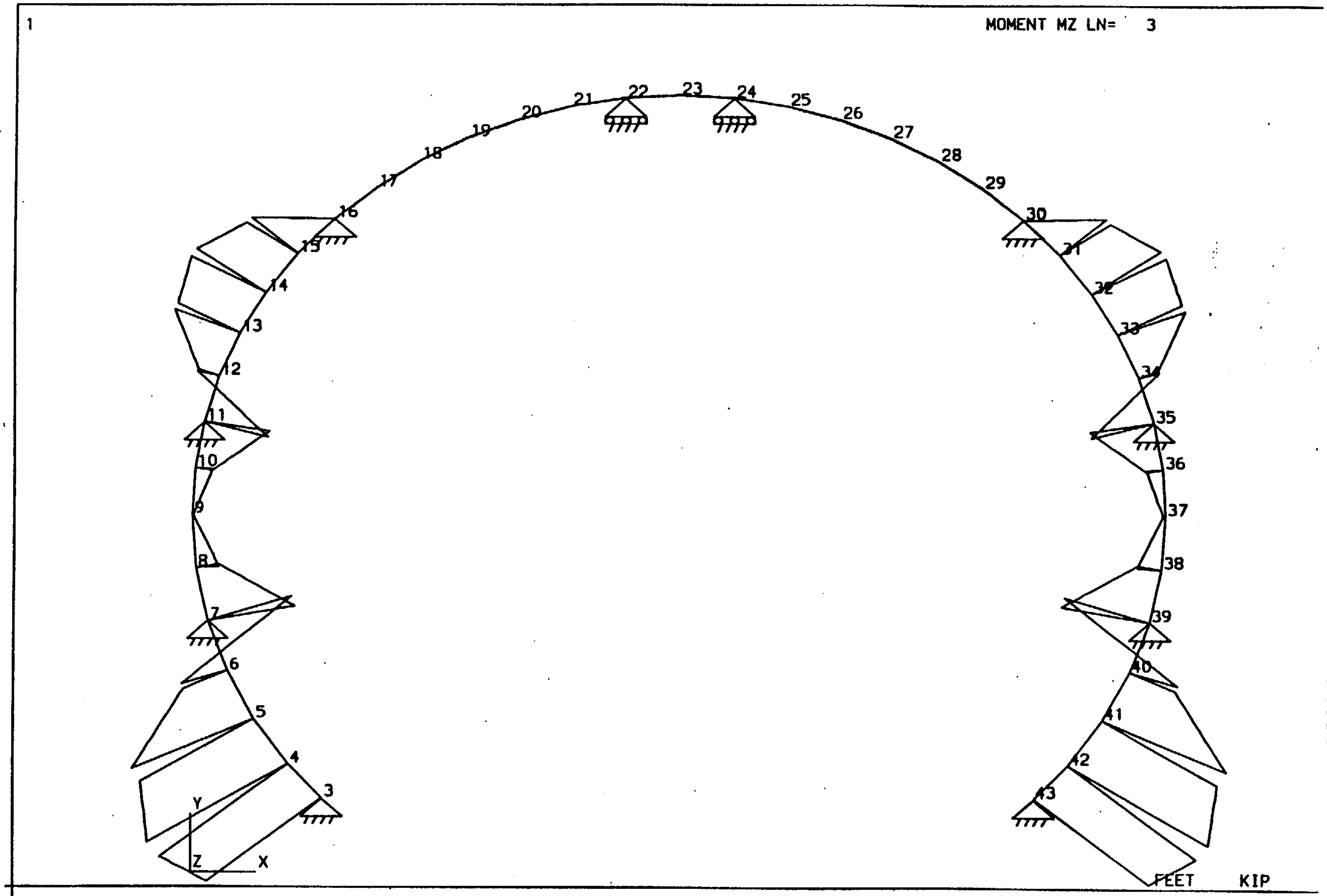
DATE= JUL 18,1995 TIME= 10:11: 7 ******



S T A A D P L - P L O T (REVISION 16.0) STLRV 3B

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0



S T A A D P L - P L O T (REVISION 16.0) STLRV 3B

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

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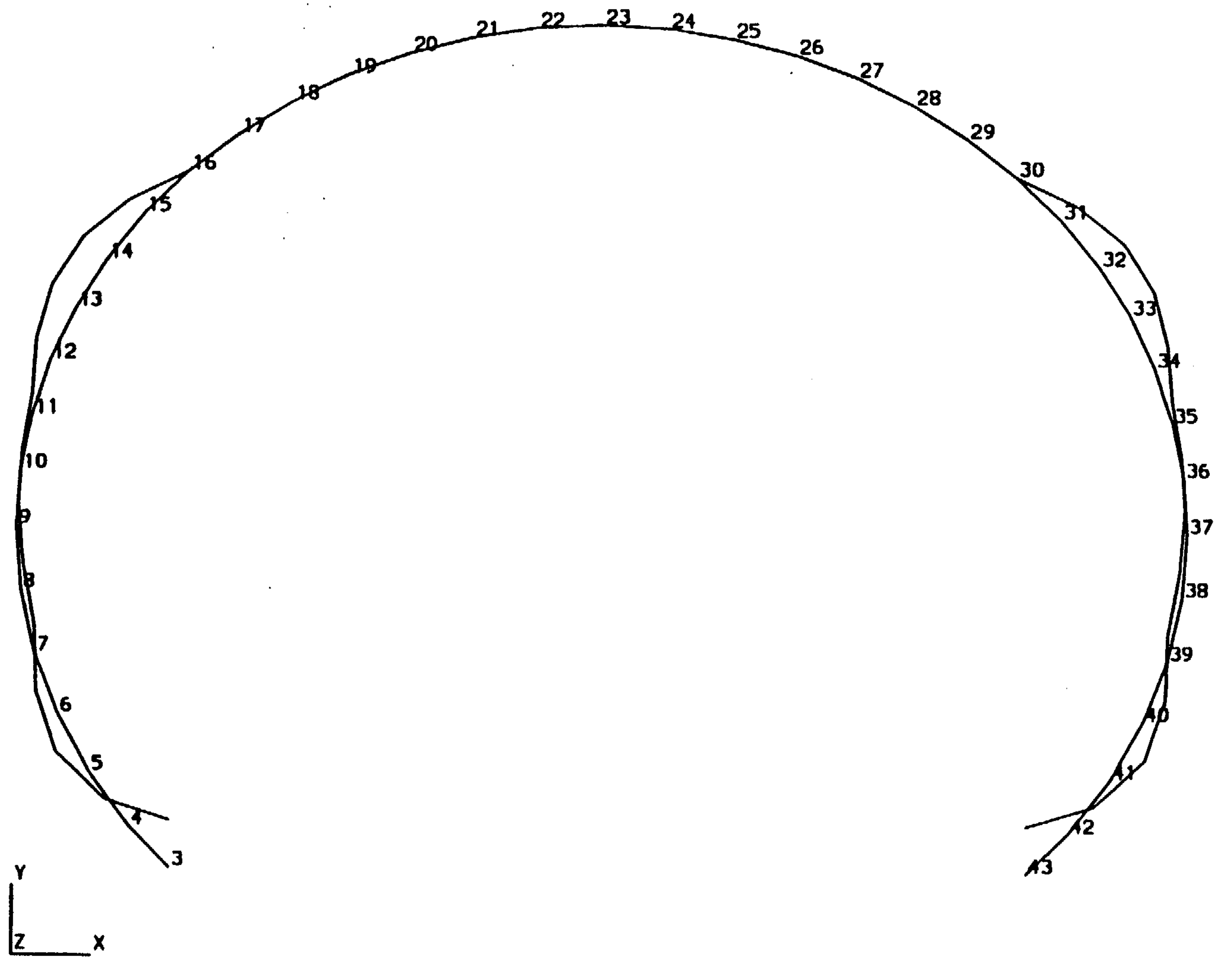
DFDR LOAD= 3



FEET KIP

S T A A D P L - P L O T (REVISION 16.0) STLRV 3B

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

```
***************************************************
*                                                 *
*             S T A A D - III                     *
*             Revision 16.0b                      *
*             Proprietary Program of              *
*             RESEARCH ENGINEERS, Inc.            *
*             Date=    JUL 18, 1995               *
*             Time=    10:20:35                   *
*                                                 *
***************************************************

 1. STAAD PLANE  BABEE0000-01717-0200-00003  ATTACHMENT I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS  REV 00
 3. * FILE STLRV3C
 4. * 25 TON JACKS APPLIED BOTH SIDES @ 49 DEGREES
 5. * MOMENT MZ RELEASED AT THE END OF MEMBERS 15 & 29
 6. * MOMENT MZ RELEASED AT THE START OF MEMBERS 16 & 30
 7. UNIT FT KIP
 8. JOINT COORDINATES
 9. 3 2.98 2.45 ; 4 2.43 3.13
10. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
11. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
12. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
13. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
14. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
15. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
16. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
17. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
18. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
19. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.35 2.45
20. MEMBER INCIDENCE
21. 3 3 4 42
22. UNIT KIP INCH
23. MEMBER RELEASE
24. 15 29 END MZ
25. 16 30 START MZ
26. MEMBER PROPERTIES
27. 3 TO 42 TA STA W8X31
28. CONSTANTS
29. E 29000.0 ALL
30. DENSITY 0.00028 ALL
31. BETA 0 ALL
32. UNIT FT
33. SUPPORT
34. 3 7 11 35 39 43 FIXED BUT FY MZ
35. 22 24 FIXED BUT FX MZ
36. 16 30 PINNED
37. UNIT KIP
38. LOAD 1
39. SELF WEIGHT Y -1.0
40. LOADING 2
41. * 25 TON JACKS & SIMULTANEOUS JACKING
42. JOINT LOADING
43. 3 FX -32.8             45. 3 FY 37.74
44. 43 FX 32.8             46. 43 FY 37.74
                          47. 43 MZ -25.00
```

```
48. 3 MZ 25.00
49. LOADING COMBINATION 3
50. 1 2.5 2 1.0
51. PERFORM ANALYSIS


       P R O B L E M   S T A T I S T I C S
       -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    41/   40/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/     1
   TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =    111
   SIZE OF STIFFNESS MATRIX =      666 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =     0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                  10:20:38
++ PROCESSING GLOBAL STIFFNESS MATRIX.                   10:20:39
++ PROCESSING TRIANGULAR FACTORIZATION.                  10:20:39
++ CALCULATING JOINT DISPLACEMENTS.                      10:20:39
++ CALCULATING MEMBER  FORCES.                           10:20:40

  52. LOAD LIST 3
  53. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06548	0.00000	0.00000	0.00000	0.00307
4	3	-0.02030	0.04668	0.00000	0.00000	0.00000	0.00205
5	3	-0.03527	0.03303	0.00000	0.00000	0.00000	0.00031
6	3	-0.02385	0.03493	0.00000	0.00000	0.00000	-0.00080
7	3	0.00000	0.03968	0.00000	0.00000	0.00000	-0.00064
8	3	0.00203	0.03742	0.00000	0.00000	0.00000	-0.00006
9	3	0.00112	0.03473	0.00000	0.00000	0.00000	0.00002
10	3	0.00161	0.03242	0.00000	0.00000	0.00000	0.00009
11	3	0.00000	0.03040	0.00000	0.00000	0.00000	0.00055
12	3	-0.01788	0.03279	0.00000	0.00000	0.00000	0.00080
13	3	-0.03076	0.03536	0.00000	0.00000	0.00000	0.00031
14	3	-0.03162	0.03283	0.00000	0.00000	0.00000	-0.00051
15	3	-0.01954	0.02107	0.00000	0.00000	0.00000	-0.00130
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	3	0.00016	-0.00024	0.00000	0.00000	0.00000	-0.00001
18	3	0.00024	-0.00042	0.00000	0.00000	0.00000	-0.00001
19	3	0.00025	-0.00050	0.00000	0.00000	0.00000	0.00000
20	3	0.00019	-0.00043	0.00000	0.00000	0.00000	0.00001
21	3	0.00010	-0.00023	0.00000	0.00000	0.00000	0.00001
22	3	0.00003	0.00000	0.00000	0.00000	0.00000	0.00001
23	3	0.00000	0.00005	0.00000	0.00000	0.00000	0.00000
24	3	-0.00003	0.00000	0.00000	0.00000	0.00000	-0.00001
25	3	-0.00010	-0.00023	0.00000	0.00000	0.00000	-0.00001
26	3	-0.00019	-0.00043	0.00000	0.00000	0.00000	-0.00001
27	3	-0.00025	-0.00050	0.00000	0.00000	0.00000	0.00000
28	3	-0.00024	-0.00042	0.00000	0.00000	0.00000	0.00001
29	3	-0.00016	-0.00024	0.00000	0.00000	0.00000	0.00001
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
31	3	0.01951	0.02105	0.00000	0.00000	0.00000	0.00130
32	3	0.03160	0.03282	0.00000	0.00000	0.00000	0.00051
33	3	0.03086	0.03543	0.00000	0.00000	0.00000	-0.00031
34	3	0.01777	0.03286	0.00000	0.00000	0.00000	-0.00080
35	3	0.00000	0.03038	0.00000	0.00000	0.00000	-0.00055
36	3	-0.00166	0.03239	0.00000	0.00000	0.00000	-0.00010
37	3	-0.00141	0.03468	0.00000	0.00000	0.00000	-0.00002
38	3	-0.00229	0.03737	0.00000	0.00000	0.00000	0.00007
39	3	0.00000	0.03958	0.00000	0.00000	0.00000	0.00066
40	3	0.02432	0.03482	0.00000	0.00000	0.00000	0.00082
41	3	0.03581	0.03288	0.00000	0.00000	0.00000	-0.00031
42	3	0.02048	0.04691	0.00000	0.00000	0.00000	-0.00207
43	3	0.00000	0.06587	0.00000	0.00000	0.00000	-0.00309

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	5.06	0.00	0.00	0.00	0.00	0.00
7	3	27.44	0.00	0.00	0.00	0.00	0.00
11	3	22.48	0.00	0.00	0.00	0.00	0.00
35	3	-22.54	0.00	0.00	0.00	0.00	0.00
39	3	-27.45	0.00	0.00	0.00	0.00	0.00
43	3	-5.03	0.00	0.00	0.00	0.00	0.00
22	3	0.00	0.20	0.00	0.00	0.00	0.00
24	3	0.00	0.20	0.00	0.00	0.00	0.00
16	3	-21.71	-35.81	0.00	0.00	0.00	0.00
30	3	21.75	-35.81	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	46.79	2.16	0.00	0.00	0.00	-25.00
		4	-46.74	-2.12	0.00	0.00	0.00	26.87
4	3	4	46.70	-2.77	0.00	0.00	0.00	-26.87
		5	-46.60	2.83	0.00	0.00	0.00	22.50
5	3	5	45.88	-8.68	0.00	0.00	0.00	-22.50
		6	-45.77	8.73	0.00	0.00	0.00	8.88
6	3	6	44.34	-14.30	0.00	0.00	0.00	-8.88
		7	-44.23	14.34	0.00	0.00	0.00	-13.49
7	3	7	36.68	6.84	0.00	0.00	0.00	13.49
		8	-36.56	-6.82	0.00	0.00	0.00	-2.78
8	3	8	37.14	2.08	0.00	0.00	0.00	2.78
		9	-37.02	-2.07	0.00	0.00	0.00	0.47
9	3	9	36.99	2.48	0.00	0.00	0.00	0.47
		10	-36.89	-2.47	0.00	0.00	0.00	2.90
10	3	10	36.39	6.50	0.00	0.00	0.00	-2.90
		11	-36.29	-6.49	0.00	0.00	0.00	11.80
11	3	11	41.50	-11.32	0.00	0.00	0.00	-11.80
		12	-41.40	11.35	0.00	0.00	0.00	-3.63
12	3	12	42.48	-6.19	0.00	0.00	0.00	3.63
		13	-42.39	6.23	0.00	0.00	0.00	-12.12
13	3	13	42.80	-1.89	0.00	0.00	0.00	12.12
		14	-42.71	1.94	0.00	0.00	0.00	-14.72
14	3	14	42.65	2.95	0.00	0.00	0.00	14.72
		15	-42.56	-2.89	0.00	0.00	0.00	-10.72
15	3	15	41.92	7.92	0.00	0.00	0.00	10.72
		16	-41.84	-7.85	0.00	0.00	0.00	0.00
16	3	16	0.70	0.09	0.00	0.00	0.00	0.00
		17	-0.63	-0.01	0.00	0.00	0.00	0.07
17	3	17	0.62	0.08	0.00	0.00	0.00	-0.07
		18	-0.56	0.01	0.00	0.00	0.00	0.12
18	3	18	0.56	0.06	0.00	0.00	0.00	-0.12
		19	-0.51	0.03	0.00	0.00	0.00	0.13

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	0.51	0.02	0.00	0.00	0.00	-0.13
		20	-0.47	0.07	0.00	0.00	0.00	0.10
20	3	20	0.48	-0.02	0.00	0.00	0.00	-0.10
		21	-0.45	0.12	0.00	0.00	0.00	0.00
21	3	21	0.46	-0.07	0.00	0.00	0.00	0.00
		22	-0.44	0.17	0.00	0.00	0.00	-0.16
22	3	22	0.47	0.08	0.00	0.00	0.00	0.16
		23	-0.46	0.03	0.00	0.00	0.00	-0.13
23	3	23	0.46	0.03	0.00	0.00	0.00	0.13
		24	-0.47	0.08	0.00	0.00	0.00	-0.16
24	3	24	0.44	0.17	0.00	0.00	0.00	0.16
		25	-0.46	-0.07	0.00	0.00	0.00	0.00
5	3	25	0.45	0.12	0.00	0.00	0.00	0.00
		26	-0.48	-0.02	0.00	0.00	0.00	0.10
26	3	26	0.47	0.07	0.00	0.00	0.00	-0.10
		27	-0.51	0.03	0.00	0.00	0.00	0.13
27	3	27	0.51	0.03	0.00	0.00	0.00	-0.13
		28	-0.56	0.06	0.00	0.00	0.00	0.12
28	3	28	0.56	0.01	0.00	0.00	0.00	-0.12
		29	-0.62	0.08	0.00	0.00	0.00	0.07
29	3	29	0.63	-0.01	0.00	0.00	0.00	-0.07
		30	-0.70	0.09	0.00	0.00	0.00	0.00
30	3	30	41.87	-7.82	0.00	0.00	0.00	0.00
		31	-41.95	7.89	0.00	0.00	0.00	-10.68
31	3	31	42.59	-2.85	0.00	0.00	0.00	10.68
		32	-42.67	2.91	0.00	0.00	0.00	-14.63
32	3	32	42.74	1.70	0.00	0.00	0.00	14.63
		33	-42.83	-1.65	0.00	0.00	0.00	-12.34
33	3	33	42.36	6.55	0.00	0.00	0.00	12.34
		34	-42.45	-6.51	0.00	0.00	0.00	-3.44
34	3	34	41.49	11.10	0.00	0.00	0.00	3.44
		35	-41.59	-11.07	0.00	0.00	0.00	11.68
35	3	35	36.29	-6.51	0.00	0.00	0.00	-11.68
		36	-36.39	6.52	0.00	0.00	0.00	2.76

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	36.90	-2.22	0.00	0.00	0.00	-2.76
		37	-37.01	2.22	0.00	0.00	0.00	-0.27
37	3	37	37.02	-2.05	0.00	0.00	0.00	-0.27
		38	-37.14	2.06	0.00	0.00	0.00	-2.95
38	3	38	36.57	-6.80	0.00	0.00	0.00	2.95
		39	-36.69	6.82	0.00	0.00	0.00	-13.63
39	3	39	44.15	14.64	0.00	0.00	0.00	13.63
		40	-44.26	-14.60	0.00	0.00	0.00	9.16
40	3	40	45.78	8.75	0.00	0.00	0.00	-9.16
		41	-45.89	-8.70	0.00	0.00	0.00	22.82
41	3	41	46.63	2.61	0.00	0.00	0.00	-22.82
		42	-46.73	-2.54	0.00	0.00	0.00	26.85
42	3	42	46.76	-2.10	0.00	0.00	0.00	-26.85
		43	-46.81	2.14	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

54. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.731	3
		46.74 C	0.00	26.87	0.87
4	ST W8X 31	PASS	AISC- H1-2	0.730	3
		46.70 C	0.00	-26.87	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.646	3
		45.88 C	0.00	-22.50	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.472	3
		44.23 C	0.00	-13.49	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.434	3
		36.68 C	0.00	13.49	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.239	3
		37.14 C	0.00	2.78	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.240	3
		36.89 C	0.00	2.90	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.401	3
		36.29 C	0.00	11.80	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.427	3
		41.50 C	0.00	-11.80	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.438	3
		42.39 C	0.00	-12.12	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.487	3
		42.71 C	0.00	-14.72	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.487	3
		42.65 C	0.00	14.72	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.409	3
		41.92 C	0.00	10.72	0.00
16	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.63 C	0.00	0.07	1.37
17	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	0.12	1.36
18	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	-0.12	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	-0.13	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.48 C	0.00	-0.10	0.00
21	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.44 C	0.00	-0.16	1.36
22	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.47 C	0.00	0.16	0.00
23	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.47 C	0.00	-0.16	1.36
24	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.44 C	0.00	0.16	0.00
25	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.48 C	0.00	0.10	1.36
26	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	0.13	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	-0.13	0.00
28	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	-0.12	0.00
29	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.63 C	0.00	-0.07	0.00
30	ST W8X 31	PASS	AISC- H1-2	0.409	3
		41.95 C	0.00	-10.68	1.36
31	ST W8X 31	PASS	AISC- H1-2	0485	3
		42.67 C	0.00	-14.63	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.485	3
		42.74 C	0.00	14.63	0.00
33	ST W8X 31	PASS	AISC- H1-2	0.442	3
		42.36 C	0.00	12.34	0.00
34	ST W8X 31	PASS	AISC- H1-2	0.425	3
		41.59 C	0.00	11.68	1.36
35	ST W8X 31	PASS	AISC- H1-2	0.398	3
		36.29 C	0.00	-11.68	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.238	3
		36.90 C	0.00	-2.76	0.00
37	ST W8X 31	PASS	AISC- H1-2	0.242	3
		37.14 C	0.00	-2.95	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.436	3
		36.69 C	0.00	-13.63	1.57
39	ST W8X 31	PASS	AISC- H1-2	0.474	3
		44.15 C	0.00	13.63	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.652	3
		45.89 C	0.00	22.82	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.730	3
		46.73 C	0.00	26.85	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.730	3
		46.76 C	0.00	-26.85	0.00

************** END OF TABULATED RESULT OF DESIGN **************

55. PLOT DISPLACEMENT FILE
56. PLOT BENDING FILE
57. FINISH

*************** END OF STAAD-III ***************

DATE= JUL 18,1995 TIME= 10:20:43 ******

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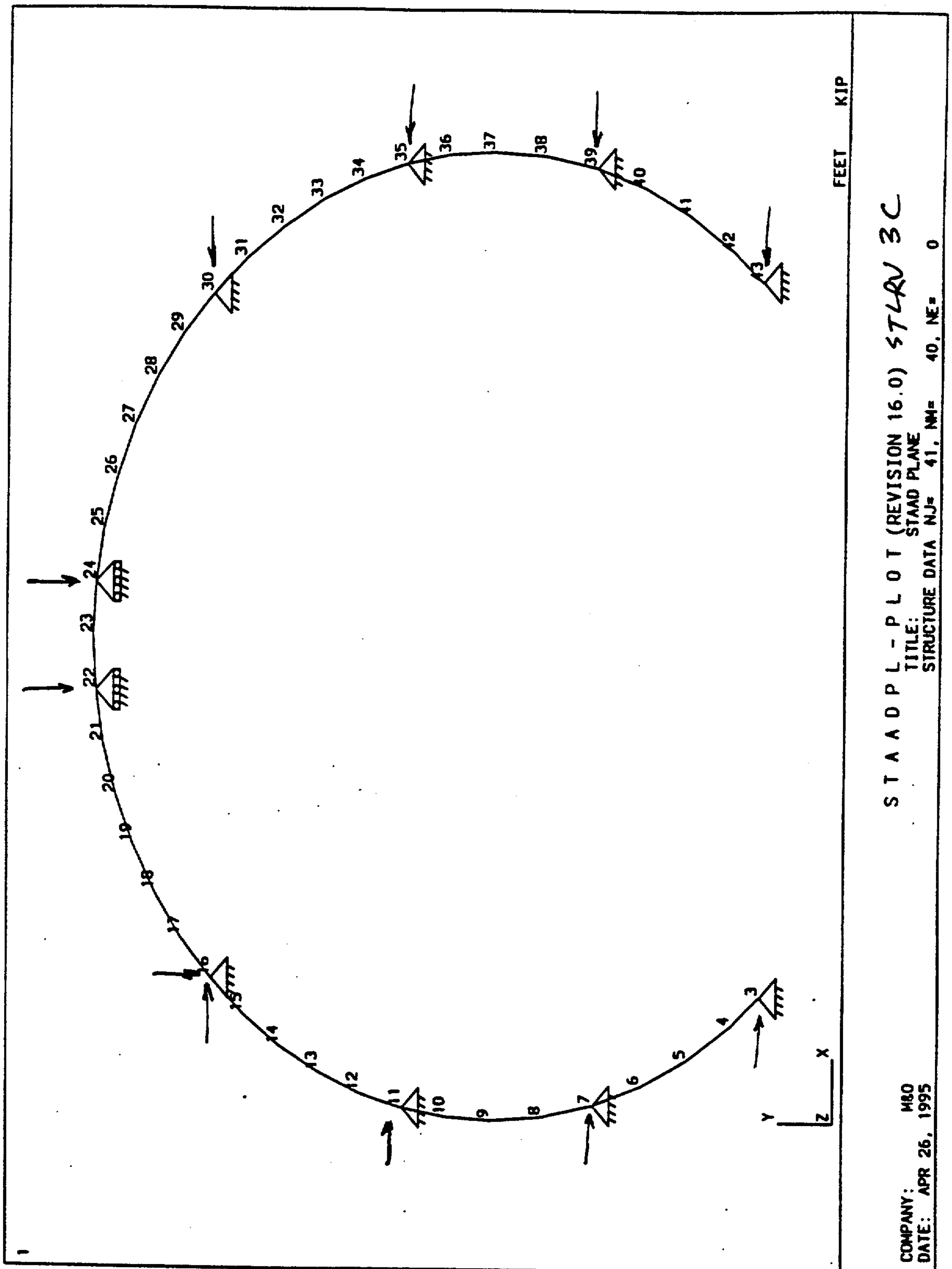
**********************************************************
*       For questions on STAAD-III/ISDS, contact:        *
*       RESEARCH ENGINEERS, Inc at (714) 974-2500        *
```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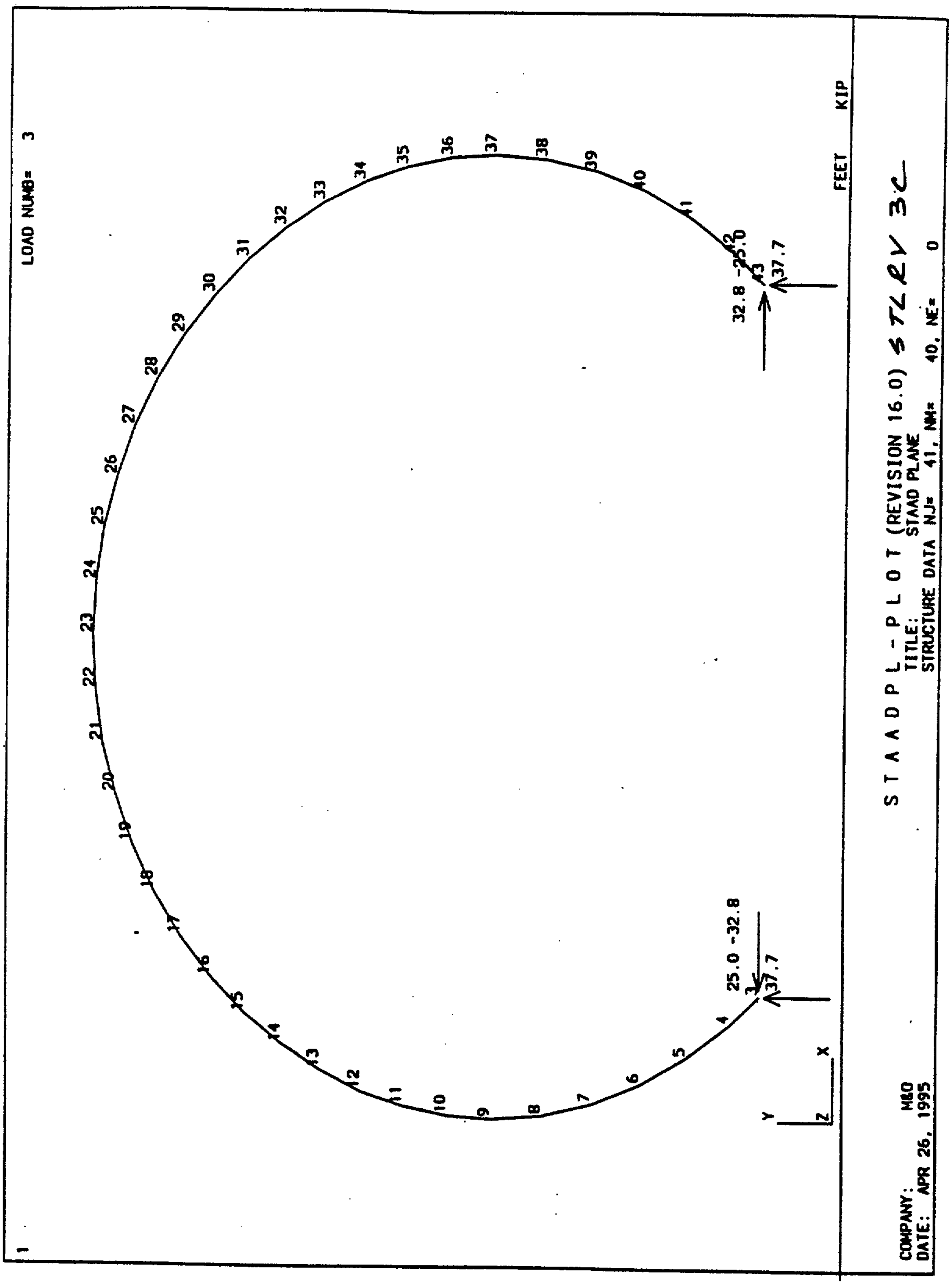
COMPANY: M&O
DATE: APR 26, 1995
FEET KIP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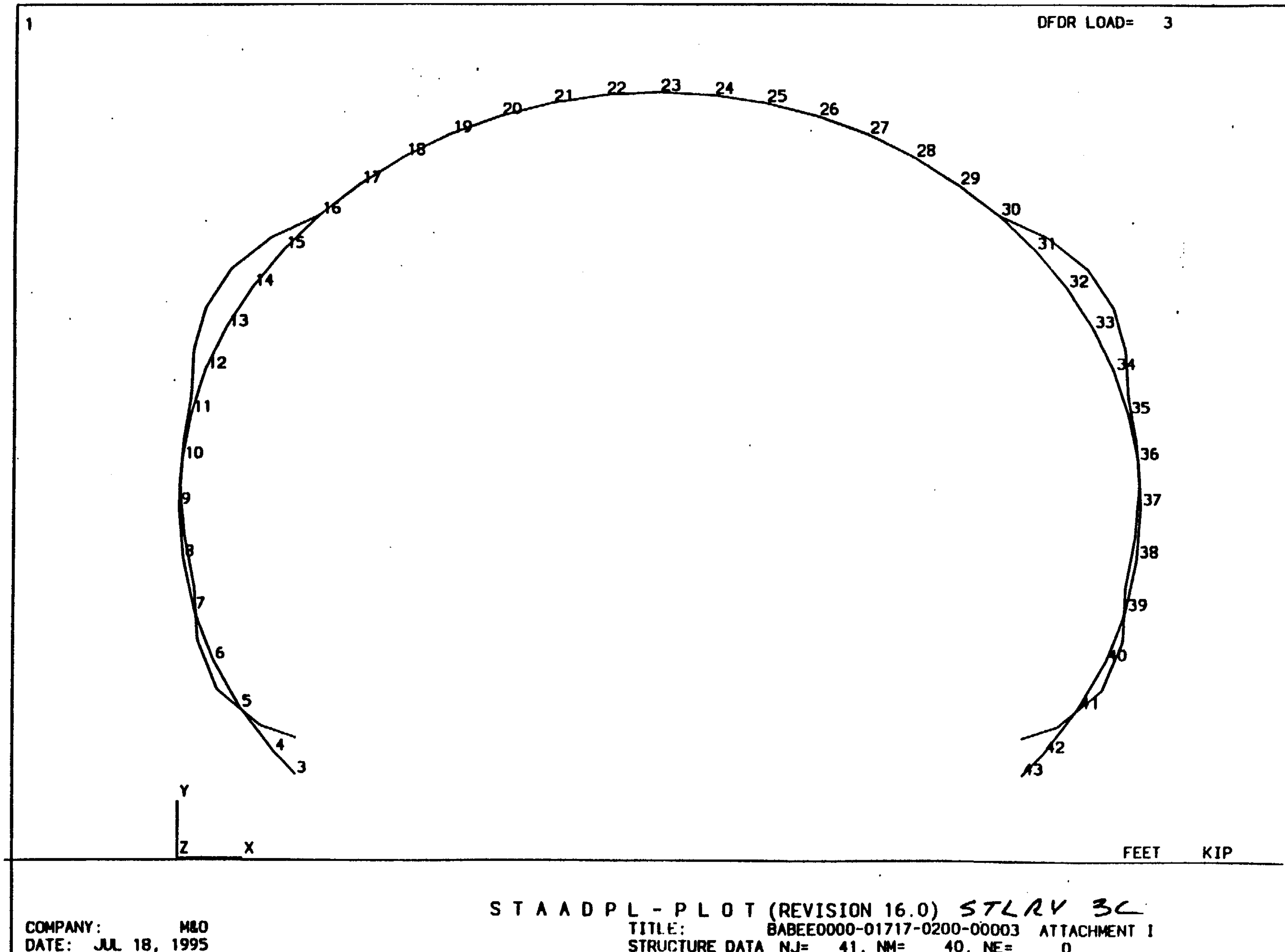
COMPANY: M&O
DATE: APR 26, 1995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X
FEET KIP
STAADPL-PLOT (REVISION 16.0) STLRV 3C
COMPANY: M&O
DATE: JUL 18, 1995
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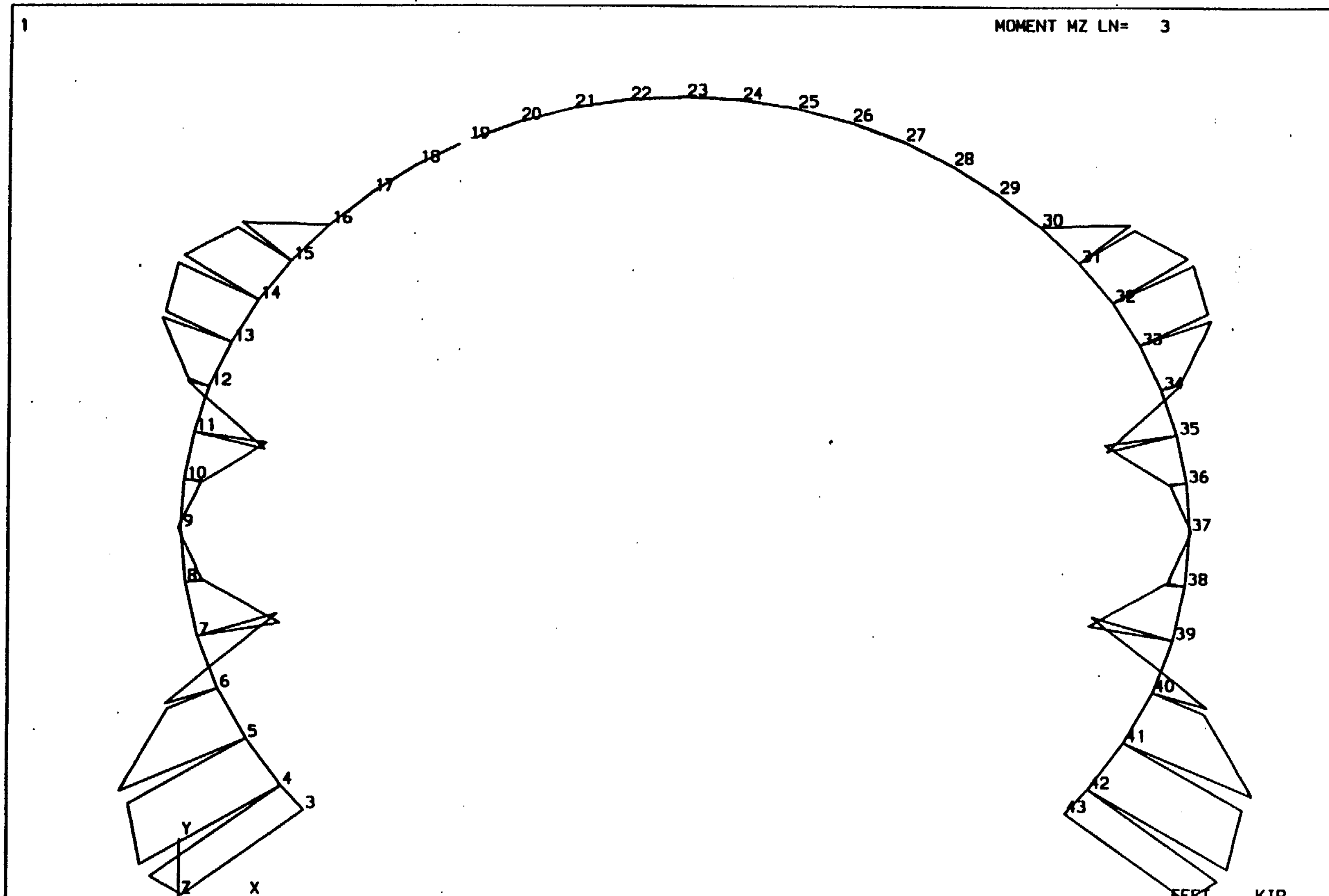
STRUCTURE DATA NJ= 41, NM= 40, NE= 0



S T A A D P L - P L O T (REVISION 16.0) STLRY 3C

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

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**************************************************
*                                                *
*          S T A A D - III                       *
*          Revision 16.0b                        *
*          Proprietary Program of                *
*          RESEARCH ENGINEERS, Inc.              *
*          Date=    JUL 18, 1995                 *
*          Time=    10:36:37                     *
*                                                *
**************************************************
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```
 1. STAAD PLANE BABEE0000-01717-0200-00003  ATTACHMENT I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. * FILE STLRV3A1
 4. * 25 TON JACKS APPLIED BOTH SIDES @ 47 DEGREES
 5. * WITH ROCK ENGAGEMENT AT MOST JOINTS
 6. UNIT FT KIP
 7. JOINT COORDINATES
 8. 3 3.27 2.13 ; 4 2.43 3.13
 9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.06 2.13
19. MEMBER INCIDENCE
20. 3 3 4 42
21. UNIT KIP INCH
22. MEMBER PROPERTIES
23. 3 TO 42 TA STA W8X31
24. CONSTANTS
25. E 29000.0 ALL
26. DENSITY 0.00028 ALL
27. BETA 0 ALL
28. UNIT FT
29. SUPPORT
30. 3 5 7 9 11 35 37 39 41 43 FIXED BUT FY MZ
31. 20 21 22 23 24 25 26 FIXED BUT FX MZ
32. 14 16 18 28 30 32 PINNED
33. UNIT KIP
34. LOAD 1
35. SELF WEIGHT Y -1.0
36. LOADING 2
37. * 25 TON JACKS & SIMULTANEOUS JACKING
38. JOINT LOADING
39. 3 FX -34.1
40. 43 FX 34.1
41. 3 FY 36.57
42. 43 FY 36.57
43. 43 MZ -25.00
44. 3 MZ 25.00
45. LOADING COMBINATION 3
46. 1 2.5 2 1.0
47. PERFORM ANALYSIS
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P R O B L E M   S T A T I S T I C S
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NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    41/    40/    23
ORIGINAL/FINAL BAND-WIDTH =     1/     1
TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =      94
SIZE OF STIFFNESS MATRIX =      564 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =     0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                   10:36:40
++ PROCESSING GLOBAL STIFFNESS MATRIX.                    10:36:41
++ PROCESSING TRIANGULAR FACTORIZATION.                   10:36:41
++ CALCULATING JOINT DISPLACEMENTS.                       10:36:41
++ CALCULATING MEMBER  FORCES.                            10:36:42

  48. LOAD LIST 3
  49. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.03461	0.00000	0.00000	0.00000	0.00163
4	3	-0.00727	0.02439	0.00000	0.00000	0.00000	0.00040
5	3	0.00000	0.02473	0.00000	0.00000	0.00000	-0.00004
6	3	-0.00104	0.02118	0.00000	0.00000	0.00000	0.00005
7	3	0.00000	0.01864	0.00000	0.00000	0.00000	0.00006
8	3	-0.00191	0.01564	0.00000	0.00000	0.00000	0.00002
9	3	0.00000	0.01319	0.00000	0.00000	0.00000	-0.00002
10	3	-0.00079	0.01102	0.00000	0.00000	0.00000	-0.00001
11	3	0.00000	0.00863	0.00000	0.00000	0.00000	0.00005
12	3	-0.00371	0.00722	0.00000	0.00000	0.00000	0.00002
13	3	-0.00337	0.00451	0.00000	0.00000	0.00000	-0.00016
14	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00015
15	3	0.00053	-0.00042	0.00000	0.00000	0.00000	-0.00002
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001
17	3	-0.00002	0.00002	0.00000	0.00000	0.00000	0.00000
18	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
19	3	0.00002	-0.00003	0.00000	0.00000	0.00000	0.00000
20	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
21	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
22	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
23	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
24	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
25	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
26	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
27	3	-0.00002	-0.00003	0.00000	0.00000	0.00000	0.00000
28	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
29	3	0.00002	0.00003	0.00000	0.00000	0.00000	0.00000
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00001
31	3	-0.00054	-0.00043	0.00000	0.00000	0.00000	0.00002
32	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00016
33	3	0.00345	0.00460	0.00000	0.00000	0.00000	0.00016
34	3	0.00358	0.00722	0.00000	0.00000	0.00000	-0.00003
35	3	0.00000	0.00864	0.00000	0.00000	0.00000	-0.00004
36	3	0.00090	0.01105	0.00000	0.00000	0.00000	0.00001
37	3	0.00000	0.01322	0.00000	0.00000	0.00000	0.00002
38	3	0.00188	0.01567	0.00000	0.00000	0.00000	-0.00002
39	3	0.00000	0.01866	0.00000	0.00000	0.00000	-0.00005
40	3	0.00115	0.02116	0.00000	0.00000	0.00000	-0.00005
41	3	0.00000	0.02476	0.00000	0.00000	0.00000	0.00004
42	3	0.00719	0.02446	0.00000	0.00000	0.00000	-0.00040
43	3	0.00000	0.03462	0.00000	0.00000	0.00000	-0.00162

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	-5.08	0.00	0.00	0.00	0.00	0.00
5	3	25.28	0.00	0.00	0.00	0.00	0.00
7	3	9.28	0.00	0.00	0.00	0.00	0.00
9	3	8.23	0.00	0.00	0.00	0.00	0.00
11	3	10.91	0.00	0.00	0.00	0.00	0.00
35	3	-11.09	0.00	0.00	0.00	0.00	0.00
37	3	-8.12	0.00	0.00	0.00	0.00	0.00
39	3	-9.17	0.00	0.00	0.00	0.00	0.00
41	3	-25.55	0.00	0.00	0.00	0.00	0.00
43	3	5.24	0.00	0.00	0.00	0.00	0.00
20	3	0.00	0.17	0.00	0.00	0.00	0.00
21	3	0.00	0.09	0.00	0.00	0.00	0.00
22	3	0.00	0.10	0.00	0.00	0.00	0.00
23	3	0.00	0.10	0.00	0.00	0.00	0.00
24	3	0.00	0.10	0.00	0.00	0.00	0.00
25	3	0.00	0.09	0.00	0.00	0.00	0.00
26	3	0.00	0.17	0.00	0.00	0.00	0.00
14	3	-13.16	-35.48	0.00	0.00	0.00	0.00
16	3	-1.44	0.51	0.00	0.00	0.00	0.00
18	3	0.10	0.15	0.00	0.00	0.00	0.00
28	3	-0.10	0.15	0.00	0.00	0.00	0.00
30	3	1.46	0.52	0.00	0.00	0.00	0.00
32	3	13.22	-35.49	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	53.20	-6.48	0.00	0.00	0.00	-25.00
		4	-53.13	6.55	0.00	0.00	0.00	16.49
4	3	4	51.92	-13.02	0.00	0.00	0.00	-16.49
		5	-51.82	13.08	0.00	0.00	0.00	-3.89
5	3	5	38.78	3.26	0.00	0.00	0.00	3.89
		6	-38.67	-3.21	0.00	0.00	0.00	1.18
6	3	6	38.78	-1.58	0.00	0.00	0.00	-1.18
		7	-38.66	1.62	0.00	0.00	0.00	-1.31
7	3	7	36.33	2.37	0.00	0.00	0.00	1.31
		8	-36.21	-2.34	0.00	0.00	0.00	2.38
8	3	8	36.21	-2.31	0.00	0.00	0.00	-2.38
		9	-36.09	2.32	0.00	0.00	0.00	-1.24
9	3	9	36.02	-1.49	0.00	0.00	0.00	-1.24
		10	-35.92	1.50	0.00	0.00	0.00	-0.79
10	3	10	35.86	2.45	0.00	0.00	0.00	0.79
		11	-35.76	-2.44	0.00	0.00	0.00	2.56
11	3	11	38.26	-4.27	0.00	0.00	0.00	-2.56
		12	-38.16	4.30	0.00	0.00	0.00	-3.28
12	3	12	38.40	0.41	0.00	0.00	0.00	3.28
		13	-38.30	-0.37	0.00	0.00	0.00	-2.75
13	3	13	38.07	4.26	0.00	0.00	0.00	2.75
		14	-37.98	-4.21	0.00	0.00	0.00	2.99
14	3	14	0.66	-1.18	0.00	0.00	0.00	-2.99
		15	-0.58	1.24	0.00	0.00	0.00	1.33
15	3	15	0.72	-1.16	0.00	0.00	0.00	-1.33
		16	-0.64	1.23	0.00	0.00	0.00	-0.29
16	3	16	0.04	0.18	0.00	0.00	0.00	0.29
		17	0.03	-0.10	0.00	0.00	0.00	-0.10
17	3	17	-0.04	0.10	0.00	0.00	0.00	0.10
		18	0.10	-0.02	0.00	0.00	0.00	-0.02
18	3	18	0.06	0.09	0.00	0.00	0.00	0.02
		19	-0.01	0.00	0.00	0.00	0.00	0.04

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	0.01	0.00	0.00	0.00	0.00	-0.04
		20	0.03	0.10	0.00	0.00	0.00	-0.03
20	3	20	0.03	0.06	0.00	0.00	0.00	0.03
		21	0.00	0.04	0.00	0.00	0.00	-0.01
21	3	21	0.02	0.05	0.00	0.00	0.00	0.01
		22	0.00	0.05	0.00	0.00	0.00	-0.01
22	3	22	0.02	0.05	0.00	0.00	0.00	0.01
		23	-0.01	0.05	0.00	0.00	0.00	-0.01
23	3	23	0.01	0.05	0.00	0.00	0.00	0.01
		24	-0.02	0.05	0.00	0.00	0.00	-0.01
24	3	24	0.00	0.05	0.00	0.00	0.00	0.01
		25	-0.02	0.05	0.00	0.00	0.00	-0.01
25	3	25	0.00	0.04	0.00	0.00	0.00	0.01
		26	-0.03	0.06	0.00	0.00	0.00	-0.03
26	3	26	-0.03	0.10	0.00	0.00	0.00	0.03
		27	-0.01	0.00	0.00	0.00	0.00	0.04
27	3	27	0.01	0.00	0.00	0.00	0.00	-0.04
		28	-0.06	0.09	0.00	0.00	0.00	-0.02
28	3	28	-0.10	-0.02	0.00	0.00	0.00	0.02
		29	0.04	0.10	0.00	0.00	0.00	-0.10
29	3	29	-0.03	-0.11	0.00	0.00	0.00	0.10
		30	-0.04	0.18	0.00	0.00	0.00	-0.30
30	3	30	0.66	1.25	0.00	0.00	0.00	0.30
		31	-0.73	-1.18	0.00	0.00	0.00	1.35
31	3	31	0.59	1.26	0.00	0.00	0.00	-1.35
		32	-0.67	-1.20	0.00	0.00	0.00	3.04
32	3	32	37.99	-4.39	0.00	0.00	0.00	-3.04
		33	-38.08	4.44	0.00	0.00	0.00	-2.96
33	3	33	38.34	-0.04	0.00	0.00	0.00	2.96
		34	-38.43	0.08	0.00	0.00	0.00	-3.04
34	3	34	38.21	4.11	0.00	0.00	0.00	3.04
		35	-38.31	-4.08	0.00	0.00	0.00	2.54
35	3	35	35.74	-2.54	0.00	0.00	0.00	-2.54
		36	-35.84	2.56	0.00	0.00	0.00	-0.95

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	35.90	1.65	0.00	0.00	0.00	0.95
		37	-36.00	-1.65	0.00	0.00	0.00	1.29
37	3	37	36.09	2.32	0.00	0.00	0.00	1.29
		38	-36.21	-2.31	0.00	0.00	0.00	2.33
38	3	38	36.21	-2.34	0.00	0.00	0.00	-2.33
		39	-36.33	2.37	0.00	0.00	0.00	-1.37
39	3	39	38.62	1.75	0.00	0.00	0.00	1.37
		40	-38.73	-1.71	0.00	0.00	0.00	1.33
40	3	40	38.63	-3.31	0.00	0.00	0.00	-1.33
		41	-38.73	3.36	0.00	0.00	0.00	-3.90
41	3	41	51.98	12.94	0.00	0.00	0.00	3.90
		42	-52.08	-12.88	0.00	0.00	0.00	16.33
42	3	42	53.23	6.67	0.00	0.00	0.00	-16.33
		43	-53.31	-6.60	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

50. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.729	3
		53.20 C	0.00	-25.00	0.00
4	ST W8X 31	PASS	AISC- H1-2	0.566	3
		51.92 C	0.00	-16.49	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.268	3
		38.78 C	0.00	3.89	0.00
6	ST W8X 31	PASS	AISC- H1-1	0.220	3
		38.66 C	0.00	-1.31	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.227	3
		36.21 C	0.00	2.38	1.57
8	ST W8X 31	PASS	AISC- H1-2	0.227	3
		36.21 C	0.00	-2.38	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.205	3
		36.02 C	0.00	-1.24	0.00
10	ST W8X 31	PASS	AISC- H1-2	0.228	3
		35.76 C	0.00	2.56	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.254	3
		38.16 C	0.00	-3.28	1.36
12	ST W8X 31	PASS	AISC- H1-2	0.255	3
		38.40 C	0.00	3.28	0.00
13	ST W8X 31	PASS	AISC- H1-2	0.248	3
		37.98 C	0.00	2.99	1.36
14	ST W8X 31	PASS	AISC- H1-3	0.058	3
		0.66 C	0.00	-2.99	0.00
15	ST W8X 31	PASS	SHEAR -Y	0.038	3
		0.64 C	0.00	-0.29	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.04 C	0.00	0.29	0.00
17	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.04 T	0.00	0.10	0.00
18	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.06 C	0.00	0.02	0.00
19	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.03 T	0.00	-0.03	1.36
20	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.03 C	0.00	0.03	0.00
21	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.02 C	0.00	0.01	0.00
22	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.02 C	0.00	0.01	0.00
23	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.01 C	0.00	0.01	0.00
24	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.00 C	0.00	0.01	0.00
25	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.03 C	0.00	-0.03	1.36
26	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.03 T	0.00	0.03	0.00

.L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

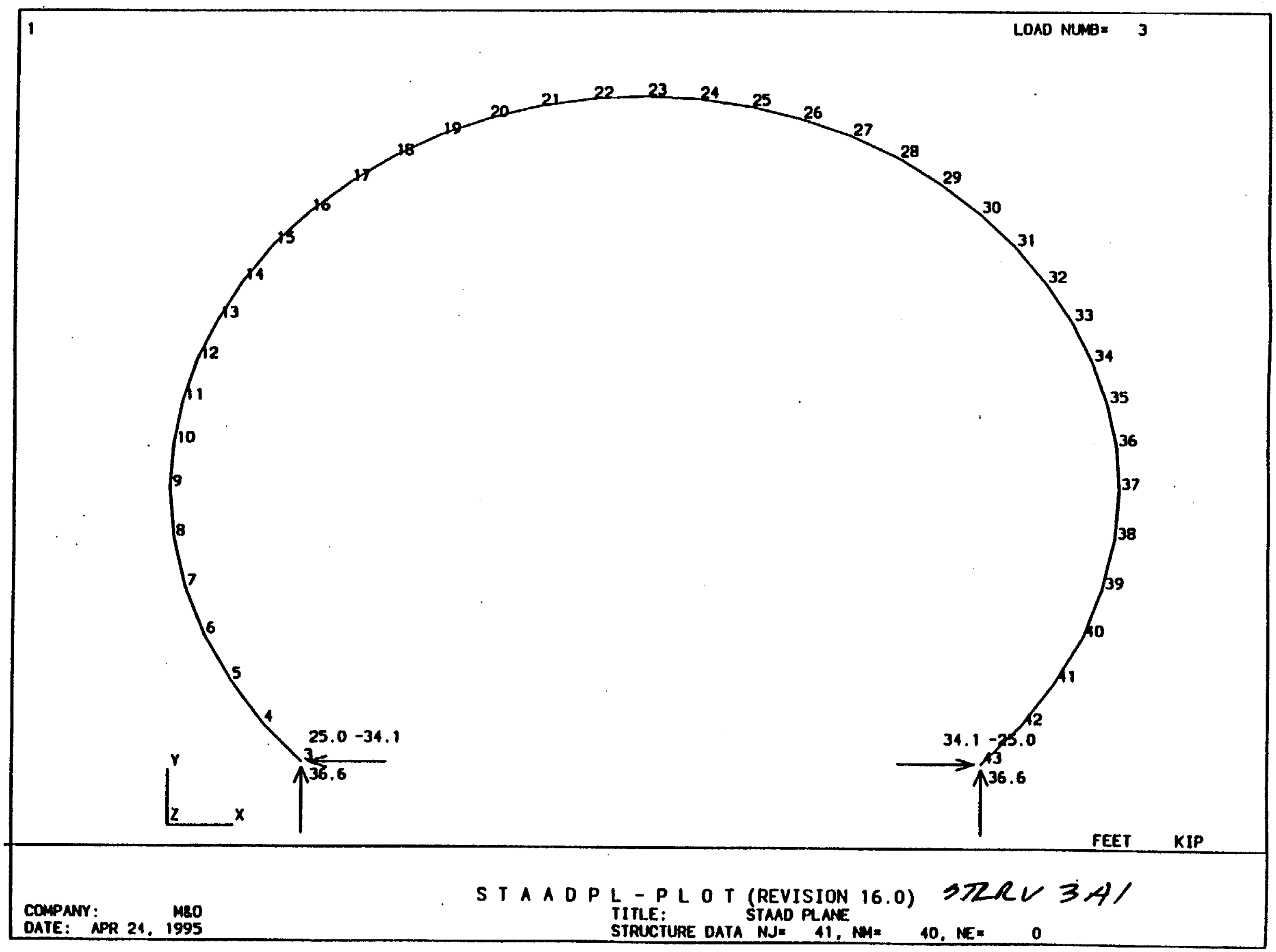
MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.06 C	0.00	-0.02	1.36
28	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.04 T	0.00	-0.10	1.36
29	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.04 C	0.00	-0.30	1.37
30	ST W8X 31	PASS	SHEAR -Y	0.038	3
		0.66 C	0.00	0.30	0.00
31	ST W8X 31	PASS	AISC- H1-3	0.059	3
		0.67 C	0.00	3.04	1.37
32	ST W8X 31	PASS	AISC- H1-2	0.248	3
		37.99 C	0.00	-3.04	0.00
33	ST W8X 31	PASS	AISC- H1-2	0.251	3
		38.43 C	0.00	-3.04	1.36
34	ST W8X 31	PASS	AISC- H1-2	0.250	3
		38.21 C	0.00	3.04	0.00
35	ST W8X 31	PASS	AISC- H1-2	0.228	3
		35.74 C	0.00	-2.54	0.00
36	ST W8X 31	PASS	AISC- H1-2	0.206	3
		36.00 C	0.00	1.29	1.36
37	ST W8X 31	PASS	AISC- H1-2	0.226	3
		36.21 C	0.00	2.33	1.56
38	ST W8X 31	PASS	AISC- H1-2	0.226	3
		36.21 C	0.00	-2.33	0.00
39	ST W8X 31	PASS	AISC- H1-1	0.221	3
		38.62 C	0.00	1.37	0.00
40	ST W8X 31	PASS	AISC- H1-2	0.268	3
		38.73 C	0.00	-3.90	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.564	3
		52.08 C	0.00	16.33	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.729	3
		53.31 C	0.00	25.00	1.31

************** END OF TABULATED RESULT OF DESIGN **************

51. PLOT DISPLACEMENT FILE
52. PLOT BENDING FILE
53. FINISH

*************** END OF STAAD-III ***************

DATE= JUL 18,1995 TIME= 10:36:45 ******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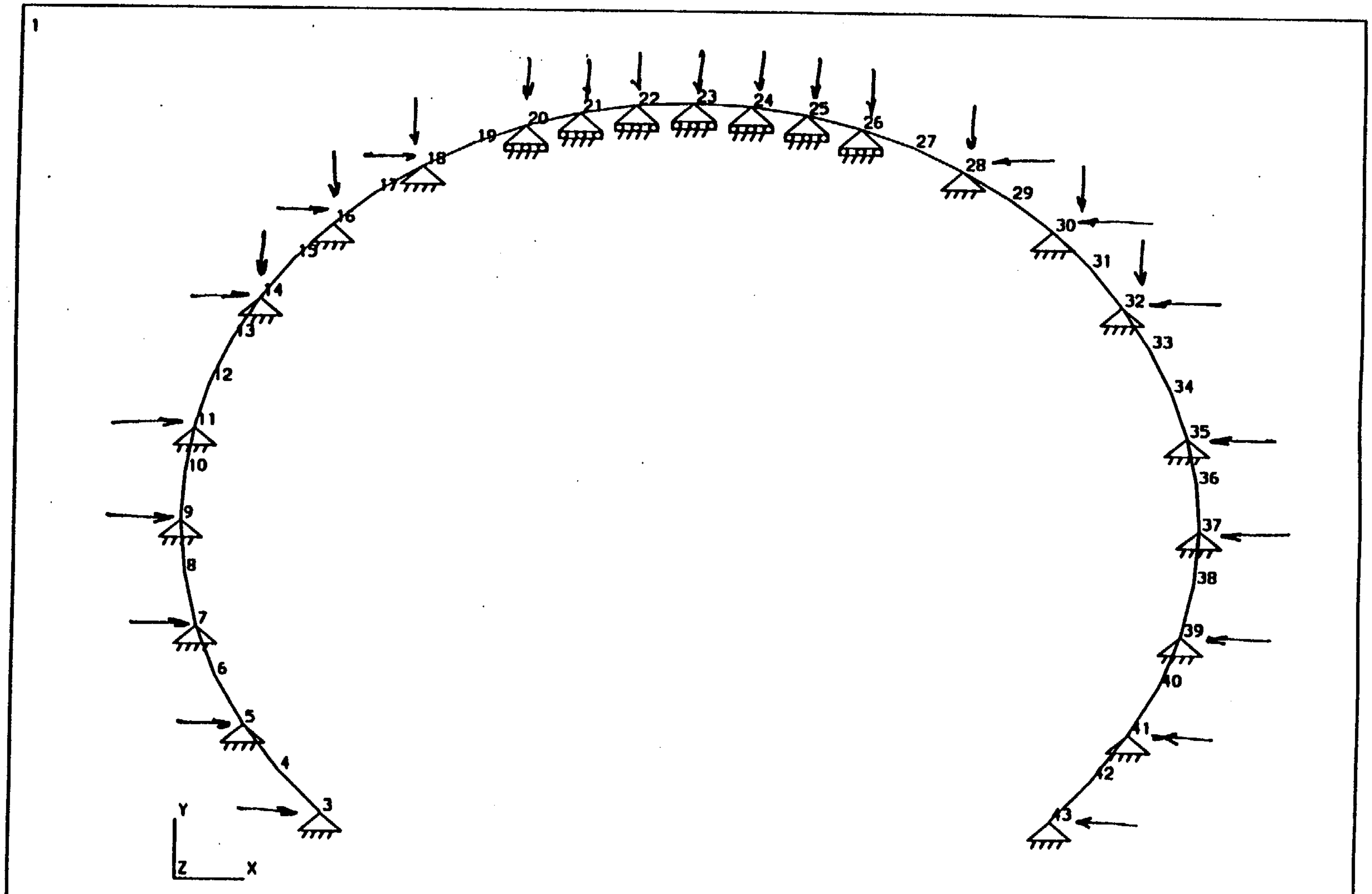
LOAD NUMB= 3
25.0 -34.1
36.6
34.1 -25.0
36.6
Y
Z X
FEET KIP
S T A A D P L - P L O T (REVISION 16.0)
COMPANY: M&O
DATE: APR 24, 1995
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

STRV 3A1

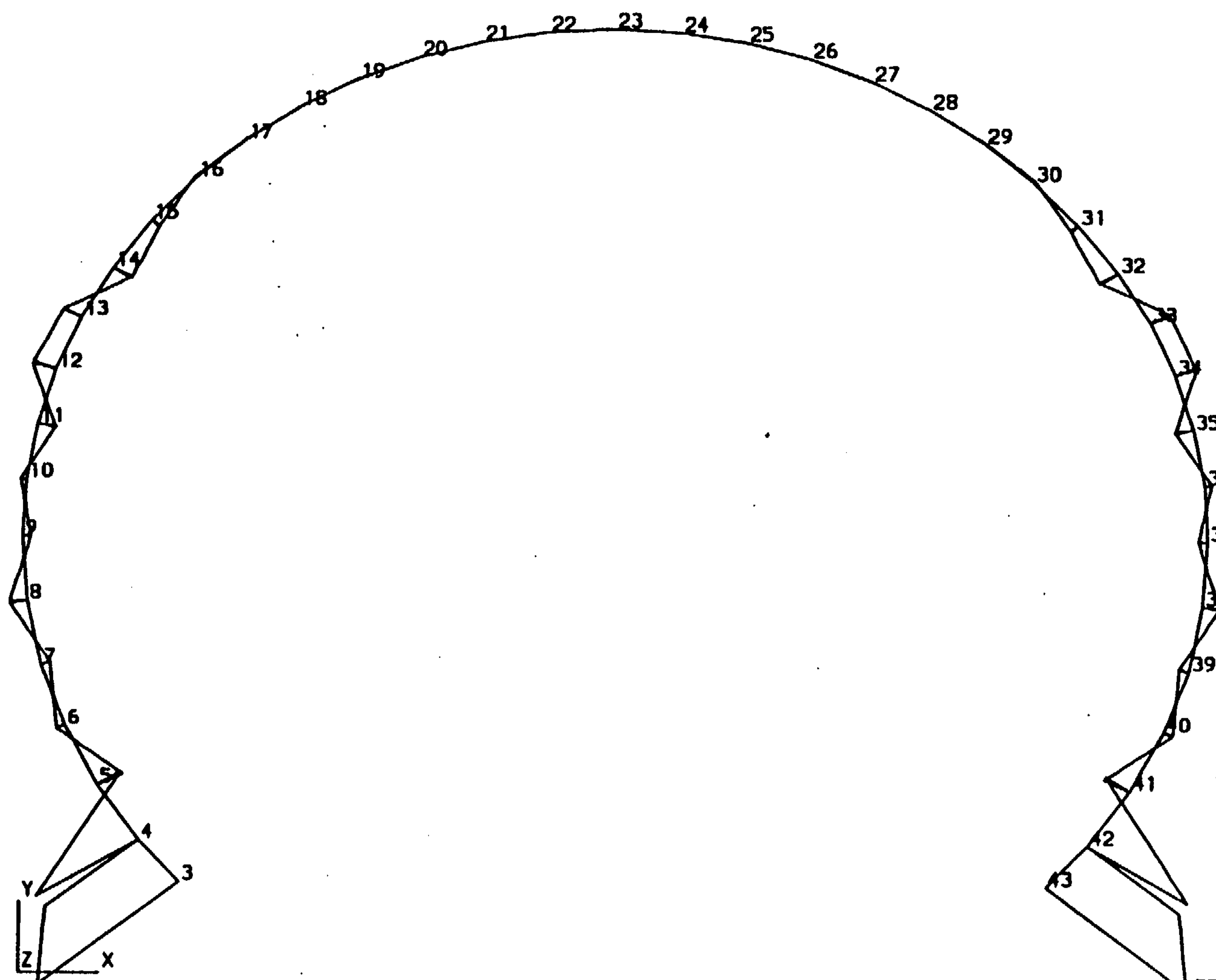


COMPANY: M&O
DATE: APR 24, 1995

S T A A D P L - P L O T (REVISION 16.0) STRV 3A1
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

1

MOMENT MZ LN= 3

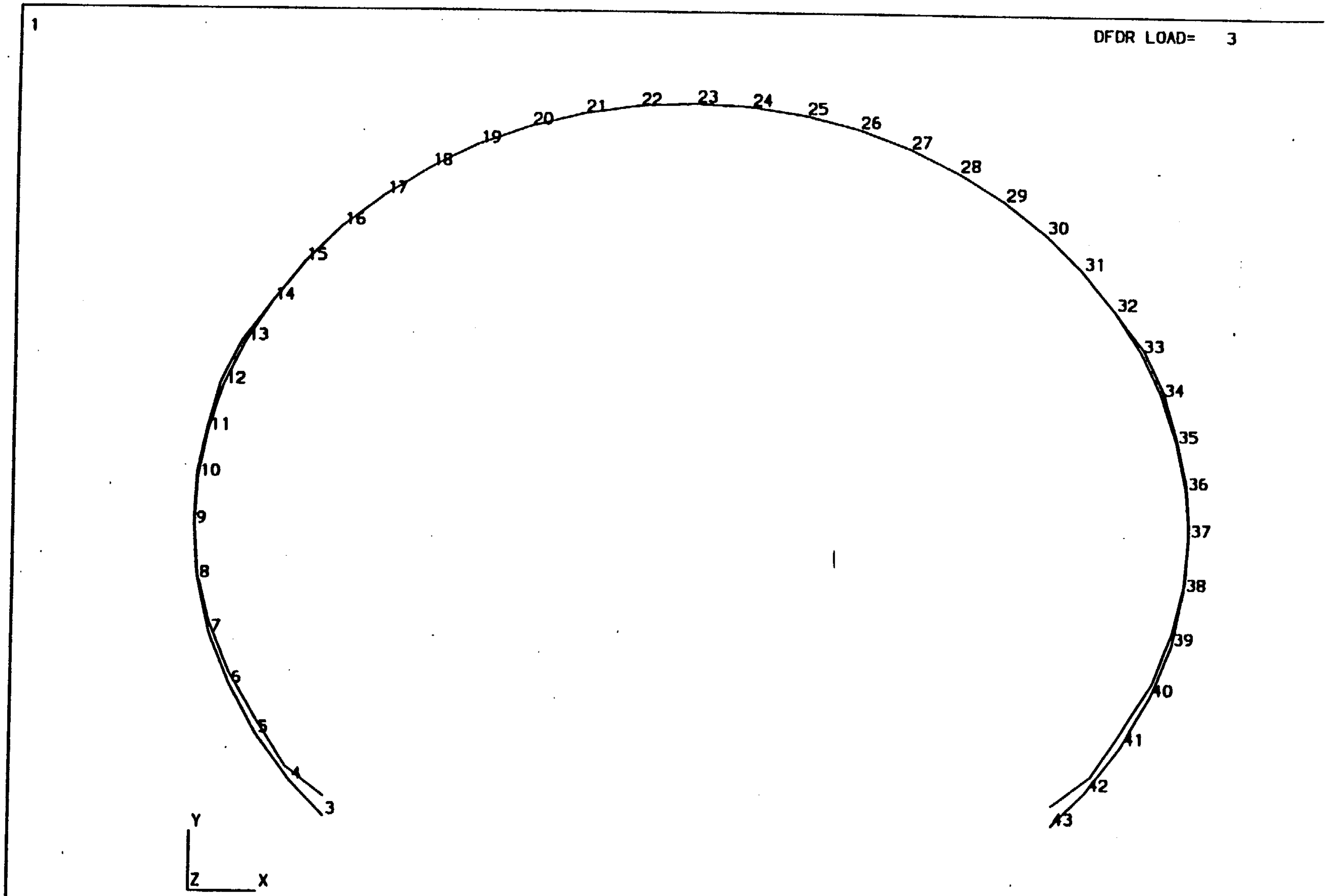


FEET KIP

S T A A D P L - P L O T (REVISION 16.0) STLRV 3A1

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0



FEET KIP

COMPANY: M&O
DATE: JUL 18, 1995

S T A A D P L - P L O T (REVISION 16.0) STCRV 3A1
TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

```
****************************************************
*                                                  *
*               S T A A D - III                    *
*               Revision 16.0b                     *
*               Proprietary Program of             *
*               RESEARCH ENGINEERS, Inc.           *
*               Date=    JUL 18, 1995              *
*               Time=    11: 2:59                  *
*                                                  *
****************************************************
```

```
 1. STAAD PLANE  BABEE0000-01717-0200-00003  ATTACHMENT I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS  REV 00
 3. * FILE STLRV3A2
 4. * 25 TON JACKS APPLIED BOTH SIDES @ 47 DEGREES
 5. * WITH ROCK ENGAGEMENT AT ALL JOINTS
 6. UNIT FT KIP
 7. JOINT COORDINATES
 8. 3 3.27 2.13 ; 4 2.43 3.13
 9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 21.06 2.13
19. MEMBER INCIDENCE
20. 3 3 4 42
21. UNIT KIP INCH
22. MEMBER PROPERTIES
23. 3 TO 42 TA STA W8X31
24. CONSTANTS
25. E 29000.0 ALL
26. DENSITY 0.00028 ALL
27. BETA 0 ALL
28. UNIT FT
29. SUPPORT
30. 3 4 5 6 7 8 9 10 11 12 13 FIXED BUT FY MZ
31. 33 34 35 36 37 38 39 40 41 42 43 FIXED BUT FY MZ
32. 19 20 21 22 23 24 25 26 27 FIXED BUT FX MZ
33. 14 15 16 17 18 28 29 30 31 32 PINNED
34. UNIT KIP
35. LOAD 1
36. SELF WEIGHT Y -1.0
37. LOADING 2
38. * 25 TON JACKS & SIMULTANEOUS JACKING
39. JOINT LOADING
40. 3 FX -34.1
41. 43 FX 34.1
42. 3 FY 36.57
43. 43 FY 36.57
44. 43 MZ -25.00
45. 3 MZ 25.00
46. LOADING COMBINATION 3
47. 1 2.5 2 1.0
```

```
48. PERFORM ANALYSIS

      P R O B L E M   S T A T I S T I C S
      -----------------------------------

 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     41/    40/    41
 ORIGINAL/FINAL BAND-WIDTH =     1/     1
 TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =      72
 SIZE OF STIFFNESS MATRIX =      288 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =     0.07 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                   11: 3: 1
++ PROCESSING GLOBAL STIFFNESS MATRIX.                    11: 3: 2
++ PROCESSING TRIANGULAR FACTORIZATION.                   11: 3: 2
++ CALCULATING JOINT DISPLACEMENTS.                       11: 3: 3
++ CALCULATING MEMBER  FORCES.                            11: 3: 3

 49. LOAD LIST 3
 50. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.03200	0.00000	0.00000	0.00000	0.00120
4	3	0.00000	0.02731	0.00000	0.00000	0.00000	0.00031
5	3	0.00000	0.02351	0.00000	0.00000	0.00000	0.00011
6	3	0.00000	0.02032	0.00000	0.00000	0.00000	0.00006
7	3	0.00000	0.01747	0.00000	0.00000	0.00000	0.00004
8	3	0.00000	0.01481	0.00000	0.00000	0.00000	0.00002
9	3	0.00000	0.01225	0.00000	0.00000	0.00000	0.00000
10	3	0.00000	0.01003	0.00000	0.00000	0.00000	-0.00002
11	3	0.00000	0.00775	0.00000	0.00000	0.00000	-0.00003
12	3	0.00000	0.00538	0.00000	0.00000	0.00000	-0.00005
13	3	0.00000	0.00279	0.00000	0.00000	0.00000	-0.00006
14	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00004
15	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00001
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
18	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
19	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
20	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
21	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
22	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
23	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
24	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
25	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
26	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
27	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
28	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
29	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
31	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001
32	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00004
33	3	0.00000	0.00282	0.00000	0.00000	0.00000	0.00006
34	3	0.00000	0.00539	0.00000	0.00000	0.00000	0.00005
35	3	0.00000	0.00777	0.00000	0.00000	0.00000	0.00003
36	3	0.00000	0.01005	0.00000	0.00000	0.00000	0.00002
37	3	0.00000	0.01227	0.00000	0.00000	0.00000	0.00000
38	3	0.00000	0.01483	0.00000	0.00000	0.00000	-0.00002
39	3	0.00000	0.01749	0.00000	0.00000	0.00000	-0.00004
40	3	0.00000	0.02033	0.00000	0.00000	0.00000	-0.00006
41	3	0.00000	0.02351	0.00000	0.00000	0.00000	-0.00011
42	3	0.00000	0.02735	0.00000	0.00000	0.00000	-0.00032
43	3	0.00000	0.03204	0.00000	0.00000	0.00000	-0.00120

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	-16.66	0.00	0.00	0.00	0.00	0.00
4	3	24.06	0.00	0.00	0.00	0.00	0.00
5	3	8.84	0.00	0.00	0.00	0.00	0.00
6	3	5.58	0.00	0.00	0.00	0.00	0.00
7	3	5.22	0.00	0.00	0.00	0.00	0.00
8	3	4.74	0.00	0.00	0.00	0.00	0.00
9	3	4.42	0.00	0.00	0.00	0.00	0.00
10	3	3.99	0.00	0.00	0.00	0.00	0.00
11	3	4.00	0.00	0.00	0.00	0.00	0.00
12	3	4.72	0.00	0.00	0.00	0.00	0.00
13	3	3.59	0.00	0.00	0.00	0.00	0.00
33	3	-4.09	0.00	0.00	0.00	0.00	0.00
34	3	-4.23	0.00	0.00	0.00	0.00	0.00
35	3	-4.24	0.00	0.00	0.00	0.00	0.00
36	3	-4.24	0.00	0.00	0.00	0.00	0.00
37	3	-4.17	0.00	0.00	0.00	0.00	0.00
38	3	-4.73	0.00	0.00	0.00	0.00	0.00
39	3	-5.00	0.00	0.00	0.00	0.00	0.00
40	3	-5.81	0.00	0.00	0.00	0.00	0.00
41	3	-9.09	0.00	0.00	0.00	0.00	0.00
42	3	-23.83	0.00	0.00	0.00	0.00	0.00
43	3	16.68	0.00	0.00	0.00	0.00	0.00
19	3	0.00	0.11	0.00	0.00	0.00	0.00
20	3	0.00	0.10	0.00	0.00	0.00	0.00
21	3	0.00	0.10	0.00	0.00	0.00	0.00
22	3	0.00	0.10	0.00	0.00	0.00	0.00
23	3	0.00	0.11	0.00	0.00	0.00	0.00
24	3	0.00	0.10	0.00	0.00	0.00	0.00
25	3	0.00	0.10	0.00	0.00	0.00	0.00
26	3	0.00	0.11	0.00	0.00	0.00	0.00
27	3	0.00	0.11	0.00	0.00	0.00	0.00
14	3	-17.91	-35.64	0.00	0.00	0.00	0.00
15	3	-0.43	0.39	0.00	0.00	0.00	0.00
16	3	-0.06	0.15	0.00	0.00	0.00	0.00
17	3	-0.01	0.11	0.00	0.00	0.00	0.00
18	3	0.00	0.11	0.00	0.00	0.00	0.00
28	3	0.00	0.11	0.00	0.00	0.00	0.00
29	3	0.01	0.11	0.00	0.00	0.00	0.00
30	3	0.06	0.15	0.00	0.00	0.00	0.00
31	3	0.44	0.40	0.00	0.00	0.00	0.00
32	3	18.16	-35.65	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	60.65	-15.34	0.00	0.00	0.00	-25.00
		4	-60.57	15.41	0.00	0.00	0.00	4.92
4	3	4	45.13	-2.55	0.00	0.00	0.00	-4.92
		5	-45.03	2.61	0.00	0.00	0.00	0.89
5	3	5	40.50	-0.30	0.00	0.00	0.00	-0.89
		6	-40.39	0.35	0.00	0.00	0.00	0.39
6	3	6	38.25	-0.03	0.00	0.00	0.00	-0.39
		7	-38.14	0.07	0.00	0.00	0.00	0.31
7	3	7	36.79	-0.02	0.00	0.00	0.00	-0.31
		8	-36.67	0.04	0.00	0.00	0.00	0.26
8	3	8	36.06	0.00	0.00	0.00	0.00	-0.26
		9	-35.94	0.01	0.00	0.00	0.00	0.25
9	3	9	35.93	0.00	0.00	0.00	0.00	0.25
		10	-35.83	0.00	0.00	0.00	0.00	-0.25
10	3	10	36.28	0.00	0.00	0.00	0.00	0.25
		11	-36.18	0.02	0.00	0.00	0.00	-0.27
11	3	11	37.06	-0.02	0.00	0.00	0.00	0.27
		12	-36.96	0.05	0.00	0.00	0.00	-0.32
12	3	12	38.52	0.13	0.00	0.00	0.00	0.32
		13	-38.42	-0.09	0.00	0.00	0.00	-0.16
13	3	13	39.93	0.85	0.00	0.00	0.00	0.16
		14	-39.84	-0.80	0.00	0.00	0.00	0.95
14	3	14	0.04	-0.57	0.00	0.00	0.00	-0.95
		15	0.04	0.63	0.00	0.00	0.00	0.13
15	3	15	0.04	-0.05	0.00	0.00	0.00	-0.13
		16	0.04	0.12	0.00	0.00	0.00	0.01
16	3	16	0.03	0.03	0.00	0.00	0.00	-0.01
		17	0.03	0.05	0.00	0.00	0.00	-0.01
17	3	17	0.03	0.04	0.00	0.00	0.00	0.01
		18	0.03	0.04	0.00	0.00	0.00	-0.01
18	3	18	0.03	0.05	0.00	0.00	0.00	0.01
		19	0.03	0.05	0.00	0.00	0.00	-0.01

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	0.02	0.05	0.00	0.00	0.00	0.01
		20	0.02	0.05	0.00	0.00	0.00	-0.01
20	3	20	0.01	0.05	0.00	0.00	0.00	0.01
		21	0.01	0.05	0.00	0.00	0.00	-0.01
21	3	21	0.01	0.05	0.00	0.00	0.00	0.01
		22	0.01	0.05	0.00	0.00	0.00	-0.01
22	3	22	0.00	0.05	0.00	0.00	0.00	0.01
		23	0.00	0.05	0.00	0.00	0.00	-0.01
23	3	23	0.00	0.05	0.00	0.00	0.00	0.01
		24	0.00	0.05	0.00	0.00	0.00	-0.01
24	3	24	-0.01	0.05	0.00	0.00	0.00	0.01
		25	-0.01	0.05	0.00	0.00	0.00	-0.01
25	3	25	-0.01	0.05	0.00	0.00	0.00	0.01
		26	-0.01	0.05	0.00	0.00	0.00	-0.01
26	3	26	-0.02	0.05	0.00	0.00	0.00	0.01
		27	-0.02	0.05	0.00	0.00	0.00	-0.01
27	3	27	-0.03	0.05	0.00	0.00	0.00	0.01
		28	-0.03	0.04	0.00	0.00	0.00	-0.01
28	3	28	-0.03	0.04	0.00	0.00	0.00	0.01
		29	-0.03	0.04	0.00	0.00	0.00	-0.01
29	3	29	-0.03	0.05	0.00	0.00	0.00	0.01
		30	-0.03	0.03	0.00	0.00	0.00	0.01
30	3	30	-0.04	0.12	0.00	0.00	0.00	-0.01
		31	-0.04	-0.05	0.00	0.00	0.00	0.13
31	3	31	-0.04	0.64	0.00	0.00	0.00	-0.13
		32	-0.04	-0.58	0.00	0.00	0.00	0.97
32	3	32	39.96	-0.83	0.00	0.00	0.00	-0.97
		33	-40.05	0.88	0.00	0.00	0.00	-0.19
33	3	33	38.33	-0.06	0.00	0.00	0.00	0.19
		34	-38.43	0.10	0.00	0.00	0.00	-0.29
4	3	34	37.03	0.02	0.00	0.00	0.00	0.29
		35	-37.13	0.01	0.00	0.00	0.00	-0.28
35	3	35	36.18	0.02	0.00	0.00	0.00	0.28
		36	-36.28	0.00	0.00	0.00	0.00	-0.27

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	35.81	0.02	0.00	0.00	0.00	0.27
		37	-35.92	-0.01	0.00	0.00	0.00	-0.24
37	3	37	35.94	0.01	0.00	0.00	0.00	-0.24
		38	-36.06	-0.01	0.00	0.00	0.00	0.26
38	3	38	36.67	0.04	0.00	0.00	0.00	-0.26
		39	-36.79	-0.01	0.00	0.00	0.00	0.30
39	3	39	38.07	0.09	0.00	0.00	0.00	-0.30
		40	-38.18	-0.05	0.00	0.00	0.00	0.40
40	3	40	40.39	0.35	0.00	0.00	0.00	-0.40
		41	-40.50	-0.29	0.00	0.00	0.00	0.91
41	3	41	45.18	2.58	0.00	0.00	0.00	-0.91
		42	-45.28	-2.51	0.00	0.00	0.00	4.90
42	3	42	60.58	15.42	0.00	0.00	0.00	-4.90
		43	-60.66	-15.36	0.00	0.00	0.00	25.00

************** END OF LATEST ANALYSIS RESULT **************

51. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.767	3
		60.65 C	0.00	-25.00	0.00
4	ST W8X 31	PASS	AISC- H1-2	0.319	3
		45.13 C	0.00	-4.92	0.00
5	ST W8X 31	PASS	AISC- H1-1	0.223	3
		40.50 C	0.00	-0.89	0.00
6	ST W8X 31	PASS	AISC- H1-1	0.204	3
		38.25 C	0.00	-0.39	0.00
7	ST W8X 31	PASS	AISC- H1-1	0.195	3
		36.79 C	0.00	-0.31	0.00
8	ST W8X 31	PASS	AISC- H1-1	0.191	3
		36.06 C	0.00	-0.26	0.00
9	ST W8X 31	PASS	AISC- H1-1	0.189	3
		35.93 C	0.00	0.25	0.00
10	ST W8X 31	PASS	AISC- H1-1	0.191	3
		36.28 C	0.00	0.25	0.00
11	ST W8X 31	PASS	AISC- H1-1	0.195	3
		36.96 C	0.00	-0.32	1.36
12	ST W8X 31	PASS	AISC- H1-1	0.204	3
		38.52 C	0.00	0.32	0.00
13	ST W8X 31	PASS	AISC- H1-1	0.220	3
		39.84 C	0.00	0.95	1.36
14	ST W8X 31	PASS	SHEAR -Y	0.019	3
		0.04 T	0.00	0.13	1.37
15	ST W8X 31	PASS	SHEAR -Y	0.004	3
		0.04 T	0.00	0.01	1.36
16	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.03 T	0.00	-0.01	1.37
17	ST W8X 31	PASS	SHEAR -Y	0.001	3
		0.03 T	0.00	-0.01	1.36
18	ST W8X 31	PASS	SHEAR -Y	0.001	3
		0.03 C	0.00	0.01	0.00
19	ST W8X 31	PASS	SHEAR -Y	0.001	3
		0.02 C	0.00	0.01	0.00
20	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.01 C	0.00	0.01	0.00
21	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.01 C	0.00	0.01	0.00
22	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.00 C	0.00	0.01	0.00
23	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.00 T	0.00	0.01	0.00
24	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.01 T	0.00	0.01	0.00
25	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.01 T	0.00	0.01	0.00
26	ST W8X 31	PASS	SHEAR -Y	0.001	3
		0.02 T	0.00	0.01	0.00

, UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	SHEAR -Y	0.001	3
		0.03 T	0.00	0.01	0.00
28	ST W8X 31	PASS	SHEAR -Y	0.001	3
		0.03 T	0.00	0.01	0.00
29	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.03	0.00	0.01	0.00
30	ST W8X 31	PASS	SHEAR -Y	0.004	3
		0.04 T	0.00	-0.01	0.00
31	ST W8X 31	PASS	SHEAR -Y	0.020	3
		0.04 T	0.00	-0.13	0.00
32	ST W8X 31	PASS	AISC- H1-1	0.221	3
		39.96 C	0.00	-0.97	0.00
33	ST W8X 31	PASS	AISC- H1-1	0.203	3
		38.43 C	0.00	-0.29	1.36
34	ST W8X 31	PASS	AISC- H1-1	0.196	3
		37.13 C	0.00	-0.28	1.36
35	ST W8X 31	PASS	AISC- H1-1	0.191	3
		36.28 C	0.00	-0.27	1.37
36	ST W8X 31	PASS	AISC- H1-1	0.189	3
		35.92 C	0.00	-0.24	1.36
37	ST W8X 31	PASS	AISC- H1-1	0.190	3
		36.06 C	0.00	0.26	1.56
38	ST W8X 31	PASS	AISC- H1-1	0.195	3
		36.79 C	0.00	0.30	1.57
39	ST W8X 31	PASS	AISC- H1-1	0.204	3
		38.18 C	0.00	0.40	1.56
40	ST W8X 31	PASS	AISC- H1-1	0.224	3
		40.50 C	0.00	0.91	1.57
41	ST W8X 31	PASS	AISC- H1-2	0.320	3
		45.28 C	0.00	4.90	1.57
42	ST W8X 31	PASS	AISC- H1-2	0.767	3
		60.66 C	0.00	25.00	1.31

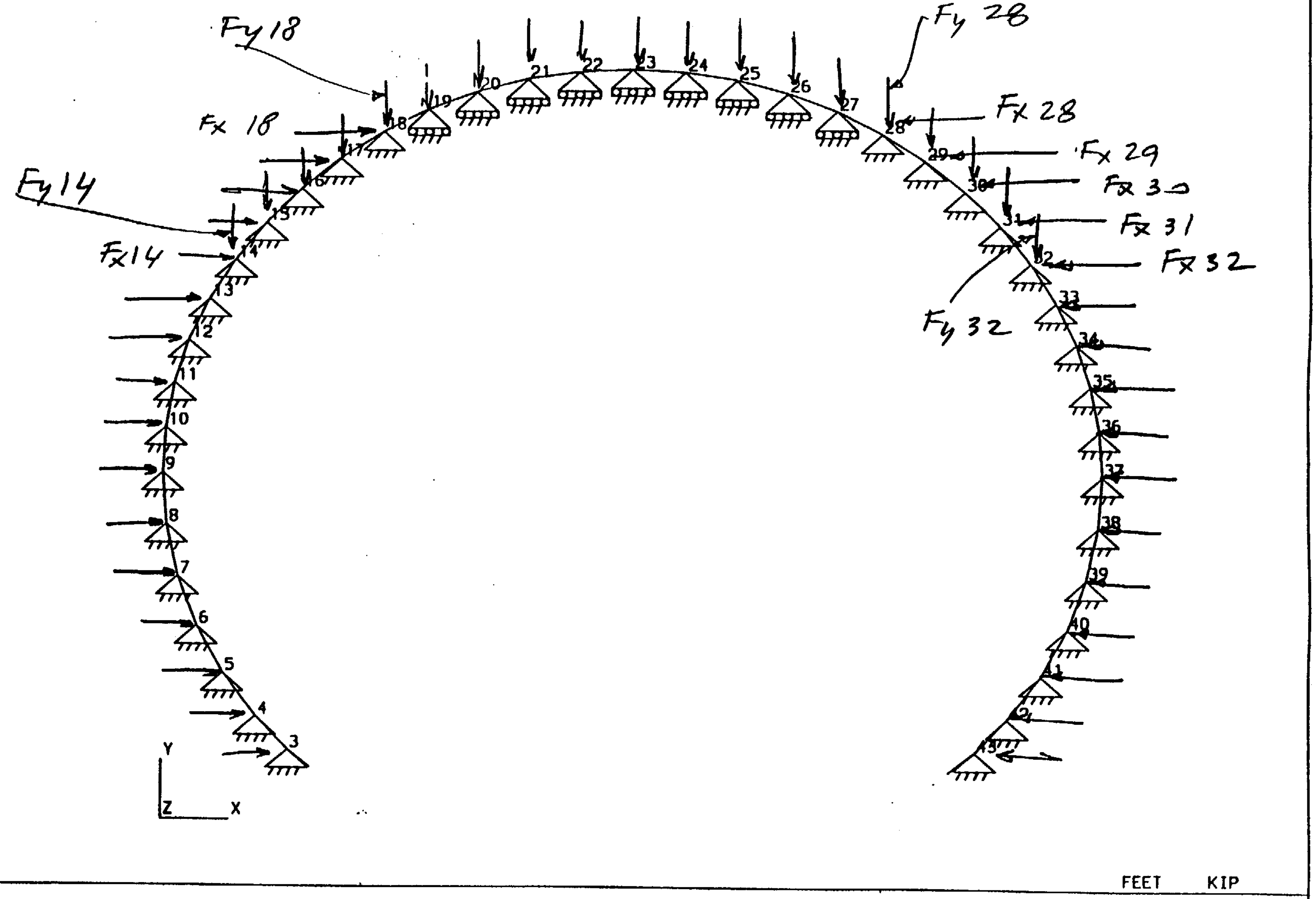
************** END OF TABULATED RESULT OF DESIGN **************

52. PLOT DISPLACEMENT FILE
53. PLOT BENDING FILE
54. FINISH

*************** END OF STAAD-III ***************

DATE= JUL 18,1995 TIME= 11: 3: 7 ******

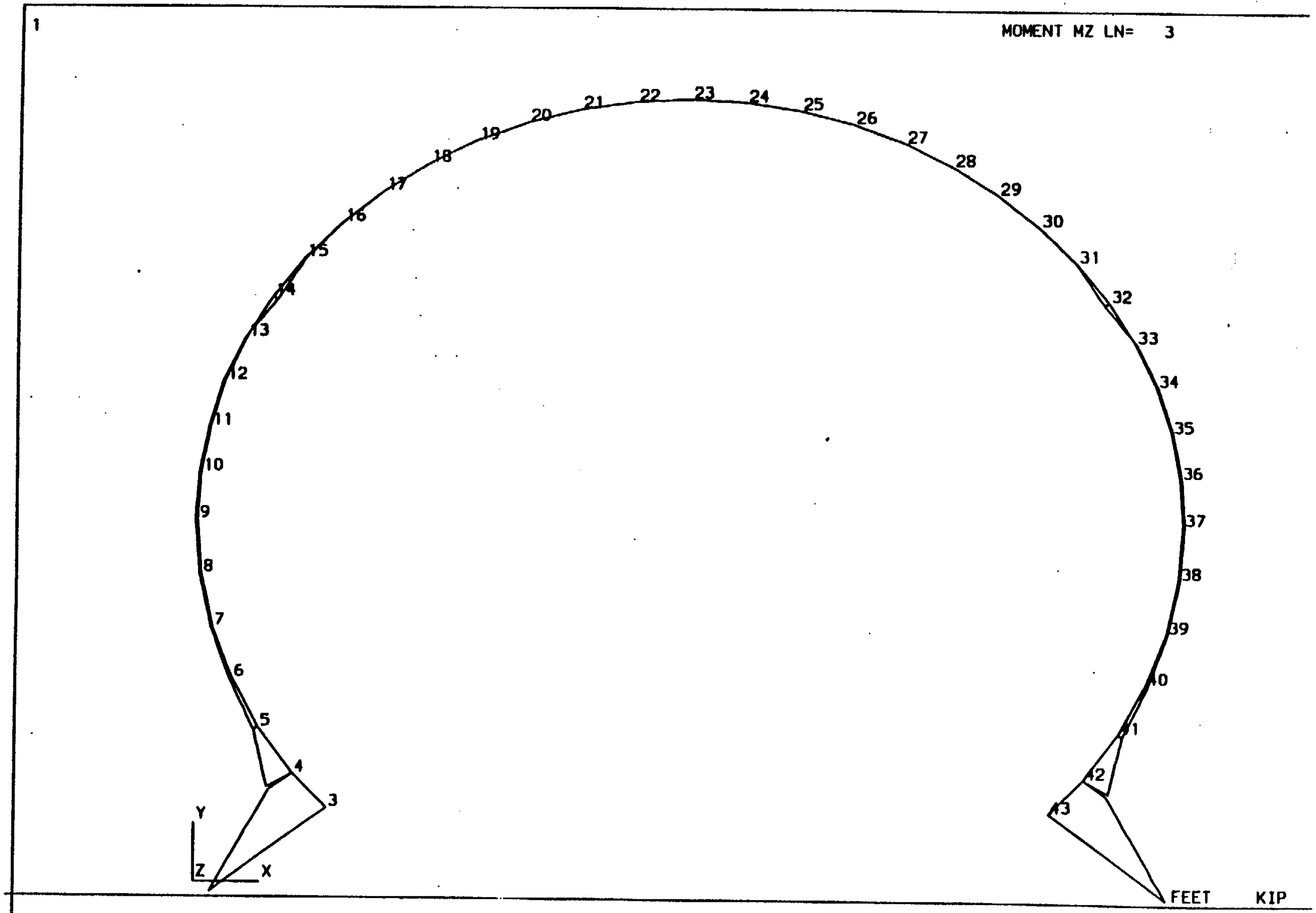
1



S T A A D P L - P L O T (REVISION 16.0)

COMPANY: M&O
DATE: SEP 12, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 43, NM= 42, NE= 0



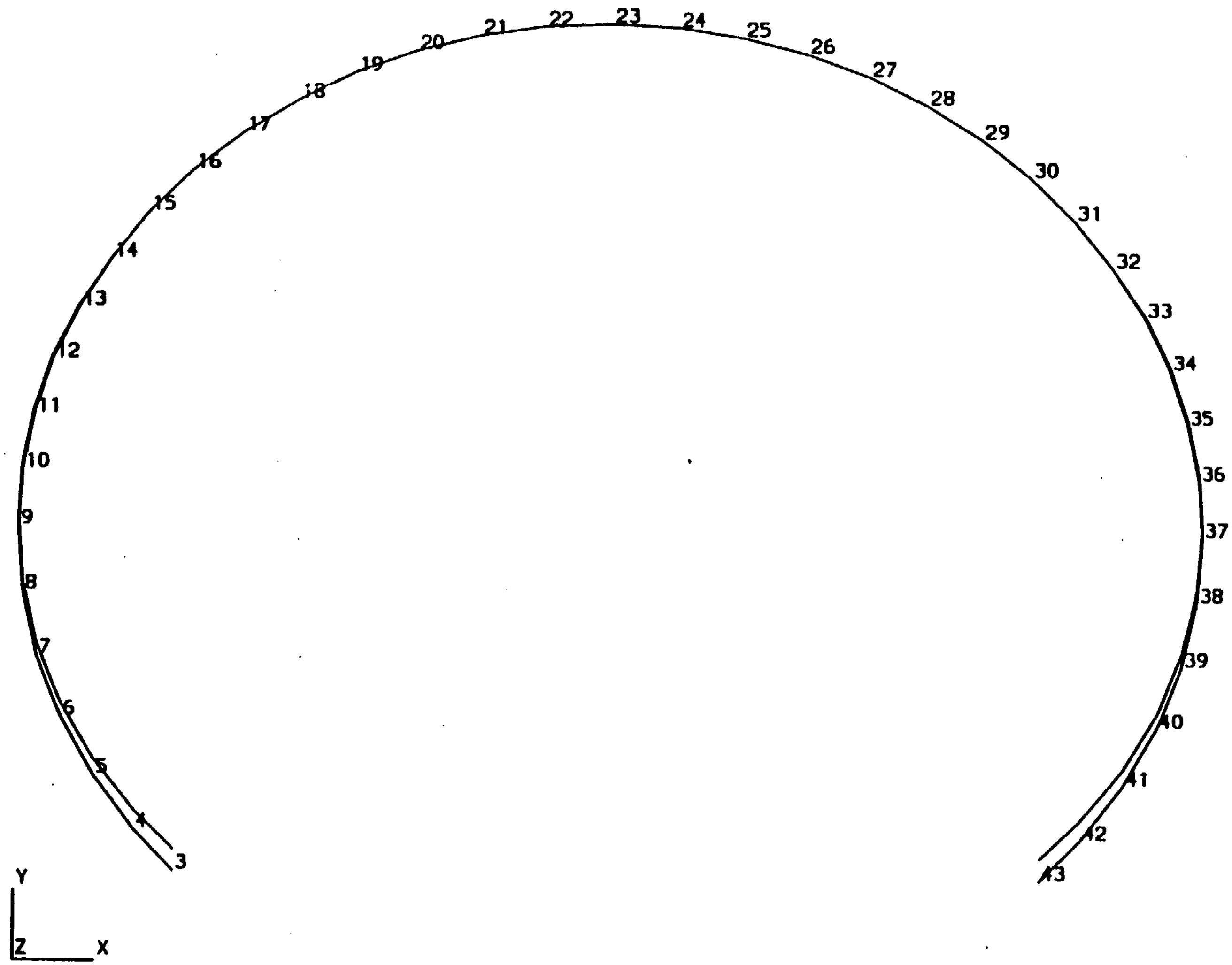
STAADPL-PLOT (REVISION 16.0) STRV 3A2

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

1

DFDR LOAD= 3



FEET KIP

S T A A D P L - P L O T (REVISION 16.0) STRU3A2

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 41, NM= 40, NE= 0

```
*                                                  *
*              S T A A D - III                     *
*              Revision 16.0b                      *
*              Proprietary Program of              *
*              RESEARCH ENGINEERS, Inc.            *
*              Date=    JUL 18, 1995               *
*              Time=      7:30: 6                  *
*                                                  *
****************************************************

  1. STAAD PLANE BABEE0000-01717-0200-00003  ATTACHMENT I
  2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
  3. *
  4. * FILE STLRV4
  5. * 25 TON JACK APPLIED ONE SIDE @ 47 DEGREES
  6. UNIT FT KIP
  7. JOINT COORDINATES
  8. 3 3.27 2.13 ; 4 2.43 3.13
  9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
 10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
 11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
 12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
 13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
 14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
 15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
 16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
 17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
 18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 20.88 1.94 ; 44 19.72 0.89
 19. 45 18.43 0.00
 20. MEMBER INCIDENCE
 21. 3 3 4 44
 22. UNIT KIP INCH
 23. MEMBER PROPERTIES
 24. 3 TO 44 TA STA W8X31
 25. CONSTANTS
 26. E 29000.0 ALL
 27. DENSITY 0.00028 ALL
 28. BETA 0 ALL
 29. UNIT FT
 30. SUPPORT
 31. 3 7 11 35 39 43 FIXED BUT FY MZ
 32. 22 24 FIXED BUT FX MZ
 33. 16 30 45 PINNED
 34. UNIT KIP
 35. LOAD 1
 36. SELF WEIGHT Y -1.0
 37. LOADING 2
 38. * 25 TON JACK & ONE SIDED JACKING
 39. JOINT LOADING
 40. 3 FX -34.1
 41. 3 FY 36.57
 42. 3 MZ 25.00
 43. LOADING COMBINATION 3
 44. 1 2.5 2 1.0
 45. PERFORM ANALYSIS
```

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        P R O B L E M   S T A T I S T I C S
        -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     43/    42/    11
   ORIGINAL/FINAL BAND-WIDTH =     1/     1
   TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =    115
   SIZE OF STIFFNESS MATRIX =      690 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =     0.08 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                   7:30: 9
++ PROCESSING GLOBAL STIFFNESS MATRIX.                    7:30:10
++ PROCESSING TRIANGULAR FACTORIZATION.                   7:30:10
++ CALCULATING JOINT DISPLACEMENTS.                       7:30:10
++ CALCULATING MEMBER  FORCES.                            7:30:11

  46. LOAD LIST 3
  47. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06495	0.00000	0.00000	0.00000	0.00341
4	3	-0.03076	0.03557	0.00000	0.00000	0.00000	0.00185
5	3	-0.04196	0.02445	0.00000	0.00000	0.00000	0.00008
6	3	-0.02664	0.02831	0.00000	0.00000	0.00000	-0.00099
7	3	0.00000	0.03408	0.00000	0.00000	0.00000	-0.00073
8	3	0.00247	0.03201	0.00000	0.00000	0.00000	-0.00006
9	3	0.00080	0.02935	0.00000	0.00000	0.00000	0.00004
10	3	0.00077	0.02714	0.00000	0.00000	0.00000	0.00007
11	3	0.00000	0.02505	0.00000	0.00000	0.00000	0.00040
12	3	-0.01365	0.02637	0.00000	0.00000	0.00000	0.00057
13	3	-0.02259	0.02741	0.00000	0.00000	0.00000	0.00016
14	3	-0.02196	0.02423	0.00000	0.00000	0.00000	-0.00044
15	3	-0.01240	0.01443	0.00000	0.00000	0.00000	-0.00088
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00077
17	3	0.00533	-0.00621	0.00000	0.00000	0.00000	-0.00035
18	3	0.00669	-0.00840	0.00000	0.00000	0.00000	-0.00007
19	3	0.00608	-0.00763	0.00000	0.00000	0.00000	0.00010
20	3	0.00487	-0.00514	0.00000	0.00000	0.00000	0.00016
21	3	0.00384	-0.00221	0.00000	0.00000	0.00000	0.00015
22	3	0.00328	0.00000	0.00000	0.00000	0.00000	0.00008
23	3	0.00307	0.00026	0.00000	0.00000	0.00000	0.00002
24	3	0.00288	0.00000	0.00000	0.00000	0.00000	0.00003
25	3	0.00289	0.00123	0.00000	0.00000	0.00000	0.00006
26	3	0.00302	0.00239	0.00000	0.00000	0.00000	0.00004
27	3	0.00300	0.00288	0.00000	0.00000	0.00000	-0.00001
28	3	0.00253	0.00246	0.00000	0.00000	0.00000	-0.00006
29	3	0.00147	0.00133	0.00000	0.00000	0.00000	-0.00010
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00009
31	3	-0.00093	-0.00089	0.00000	0.00000	0.00000	-0.00006
32	3	-0.00136	-0.00125	0.00000	0.00000	0.00000	-0.00001
33	3	-0.00124	-0.00122	0.00000	0.00000	0.00000	0.00002
34	3	-0.00068	-0.00102	0.00000	0.00000	0.00000	0.00003
35	3	0.00000	-0.00084	0.00000	0.00000	0.00000	0.00003
36	3	0.00023	-0.00081	0.00000	0.00000	0.00000	0.00001
37	3	0.00023	-0.00081	0.00000	0.00000	0.00000	0.00000
38	3	0.00010	-0.00079	0.00000	0.00000	0.00000	0.00000
39	3	0.00000	-0.00075	0.00000	0.00000	0.00000	0.00000
40	3	0.00027	-0.00081	0.00000	0.00000	0.00000	0.00001
41	3	0.00041	-0.00083	0.00000	0.00000	0.00000	0.00000
42	3	0.00027	-0.00068	0.00000	0.00000	0.00000	-0.00001
43	3	0.00000	-0.00038	0.00000	0.00000	0.00000	-0.00001
44	3	0.00006	-0.00029	0.00000	0.00000	0.00000	-0.00001
45	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00001

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	6.29	0.00	0.00	0.00	0.00	0.00
7	3	28.29	0.00	0.00	0.00	0.00	0.00
11	3	19.23	0.00	0.00	0.00	0.00	0.00
35	3	0.48	0.00	0.00	0.00	0.00	0.00
39	3	-0.41	0.00	0.00	0.00	0.00	0.00
43	3	-0.93	0.00	0.00	0.00	0.00	0.00
22	3	0.00	1.24	0.00	0.00	0.00	0.00
24	3	0.00	-2.05	0.00	0.00	0.00	0.00
16	3	-16.75	-34.69	0.00	0.00	0.00	0.00
30	3	-3.37	2.49	0.00	0.00	0.00	0.00
45	3	1.26	1.03	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	45.89	2.23	0.00	0.00	0.00	-25.00
		4	-45.81	-2.16	0.00	0.00	0.00	27.87
4	3	4	45.73	-3.48	0.00	0.00	0.00	-27.87
		5	-45.63	3.54	0.00	0.00	0.00	22.39
5	3	5	44.82	-9.26	0.00	0.00	0.00	-22.39
		6	-44.71	9.31	0.00	0.00	0.00	7.85
6	3	6	43.22	-14.75	0.00	0.00	0.00	-7.85
		7	-43.11	14.79	0.00	0.00	0.00	-15.22
7	3	7	35.35	7.38	0.00	0.00	0.00	15.22
		8	-35.23	-7.35	0.00	0.00	0.00	-3.66
8	3	8	35.89	2.78	0.00	0.00	0.00	3.66
		9	-35.77	-2.78	0.00	0.00	0.00	0.68
9	3	9	35.84	1.63	0.00	0.00	0.00	0.68
		10	-35.73	-1.62	0.00	0.00	0.00	1.53
10	3	10	35.34	5.53	0.00	0.00	0.00	-1.53
		11	-35.23	-5.51	0.00	0.00	0.00	9.09
11	3	11	39.68	-9.28	0.00	0.00	0.00	-9.09
		12	-39.58	9.31	0.00	0.00	0.00	-3.56
12	3	12	40.42	-4.39	0.00	0.00	0.00	3.56
		13	-40.32	4.43	0.00	0.00	0.00	-9.59
13	3	13	40.56	-0.31	0.00	0.00	0.00	9.59
		14	-40.47	0.36	0.00	0.00	0.00	-10.04
14	3	14	40.25	4.26	0.00	0.00	0.00	10.04
		15	-40.16	-4.20	0.00	0.00	0.00	-4.24
15	3	15	39.38	8.94	0.00	0.00	0.00	4.24
		16	-39.30	-8.87	0.00	0.00	0.00	7.88
16	3	16	2.51	-1.64	0.00	0.00	0.00	-7.88
		17	-2.44	1.72	0.00	0.00	0.00	5.58
17	3	17	2.62	-1.44	0.00	0.00	0.00	-5.58
		18	-2.56	1.53	0.00	0.00	0.00	3.56
18	3	18	2.72	-1.22	0.00	0.00	0.00	-3.56
		19	-2.67	1.31	0.00	0.00	0.00	1.82

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	2.80	-1.01	0.00	0.00	0.00	-1.82
		20	-2.76	1.10	0.00	0.00	0.00	0.38
20	3	20	2.86	-0.80	0.00	0.00	0.00	-0.38
		21	-2.83	0.90	0.00	0.00	0.00	-0.77
21	3	21	2.91	-0.58	0.00	0.00	0.00	0.77
		22	-2.90	0.68	0.00	0.00	0.00	-1.62
22	3	22	3.03	0.89	0.00	0.00	0.00	1.62
		23	-3.02	-0.78	0.00	0.00	0.00	-0.48
23	3	23	2.91	1.13	0.00	0.00	0.00	0.48
		24	-2.91	-1.02	0.00	0.00	0.00	0.99
24	3	24	3.13	-0.68	0.00	0.00	0.00	-0.99
		25	-3.15	0.78	0.00	0.00	0.00	0.00
25	3	25	3.21	-0.42	0.00	0.00	0.00	0.00
		26	-3.24	0.52	0.00	0.00	0.00	-0.65
26	3	26	3.28	-0.18	0.00	0.00	0.00	0.65
		27	-3.32	0.27	0.00	0.00	0.00	-0.96
27	3	27	3.33	0.12	0.00	0.00	0.00	0.96
		28	-3.38	-0.03	0.00	0.00	0.00	-0.86
28	3	28	3.36	0.40	0.00	0.00	0.00	0.86
		29	-3.42	-0.32	0.00	0.00	0.00	-0.37
29	3	29	3.36	0.69	0.00	0.00	0.00	0.37
		30	-3.43	-0.61	0.00	0.00	0.00	0.52
30	3	30	-0.76	0.15	0.00	0.00	0.00	-0.52
		31	0.68	-0.08	0.00	0.00	0.00	0.68
31	3	31	-0.69	0.00	0.00	0.00	0.00	-0.68
		32	0.60	0.06	0.00	0.00	0.00	0.64
32	3	32	-0.59	-0.13	0.00	0.00	0.00	-0.64
		33	0.50	0.18	0.00	0.00	0.00	0.43
33	3	33	-0.48	-0.23	0.00	0.00	0.00	-0.43
		34	0.38	0.27	0.00	0.00	0.00	0.09
34	3	34	-0.35	-0.31	0.00	0.00	0.00	-0.09
		35	0.25	0.34	0.00	0.00	0.00	-0.36
35	3	35	-0.13	0.11	0.00	0.00	0.00	0.36
		36	0.02	-0.09	0.00	0.00	0.00	-0.23

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	-0.03	0.09	0.00	0.00	0.00	0.23
		37	-0.07	-0.08	0.00	0.00	0.00	-0.11
37	3	37	0.06	-0.09	0.00	0.00	0.00	-0.11
		38	-0.18	0.10	0.00	0.00	0.00	-0.03
38	3	38	0.17	-0.12	0.00	0.00	0.00	0.03
		39	-0.28	0.14	0.00	0.00	0.00	-0.23
39	3	39	0.39	0.22	0.00	0.00	0.00	0.23
		40	-0.51	-0.18	0.00	0.00	0.00	0.08
40	3	40	0.53	0.11	0.00	0.00	0.00	-0.08
		41	-0.63	-0.06	0.00	0.00	0.00	0.21
41	3	41	0.64	-0.02	0.00	0.00	0.00	-0.21
		42	-0.74	0.09	0.00	0.00	0.00	0.12
42	3	42	0.72	-0.18	0.00	0.00	0.00	-0.12
		43	-0.81	0.26	0.00	0.00	0.00	-0.22
43	3	43	1.46	0.26	0.00	0.00	0.00	0.22
		44	-1.54	-0.18	0.00	0.00	0.00	0.12
44	3	44	1.55	-0.03	0.00	0.00	0.00	-0.12
		45	-1.62	0.13	0.00	0.00	0.00	0.00

************** END OF LATEST ANALYSIS RESULT **************

48. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.744	3
		45.81 C	0.00	27.87	1.31
4	ST W8X 31	PASS	AISC- H1-2	0.744	3
		45.73 C	0.00	-27.87	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.638	3
		44.82 C	0.00	-22.39	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.498	3
		43.11 C	0.00	-15.22	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.459	3
		35.35 C	0.00	15.22	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.249	3
		35.89 C	0.00	3.66	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.209	3
		35.73 C	0.00	1.53	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.346	3
		35.23 C	0.00	9.09	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.368	3
		39.68 C	0.00	-9.09	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.381	3
		40.32 C	0.00	-9.59	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.390	3
		40.47 C	0.00	-10.04	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.388	3
		40.25 C	0.00	10.04	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.344	3
		39.30 C	0.00	7.88	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.158	3
		2.51 C	0.00	-7.88	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.116	3
		2.62 C	0.00	-5.58	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.079	3
		2.72 C	0.00	-3.56	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.048	3
		2.80 C	0.00	-1.82	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.029	3
		2.83 C	0.00	-0.77	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.045	3
		2.90 C	0.00	-1.62	1.36
22	ST W8X 31	PASS	AISC- H1-3	0.045	3
		3.03 C	0.00	1.62	0.00
23	ST W8X 31	PASS	SHEAR -Y	0.034	3
		2.91 C	0.00	0.48	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.034	3
		3.13 C	0.00	-0.99	0.00
25	ST W8X 31	PASS	AISC- H1-3	0.029	3
		3.24 C	0.00	-0.65	1.36
26	ST W8X 31	PASS	AISC- H1-3	0.035	3
		3.32 C	0.00	-0.96	1.37

, UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

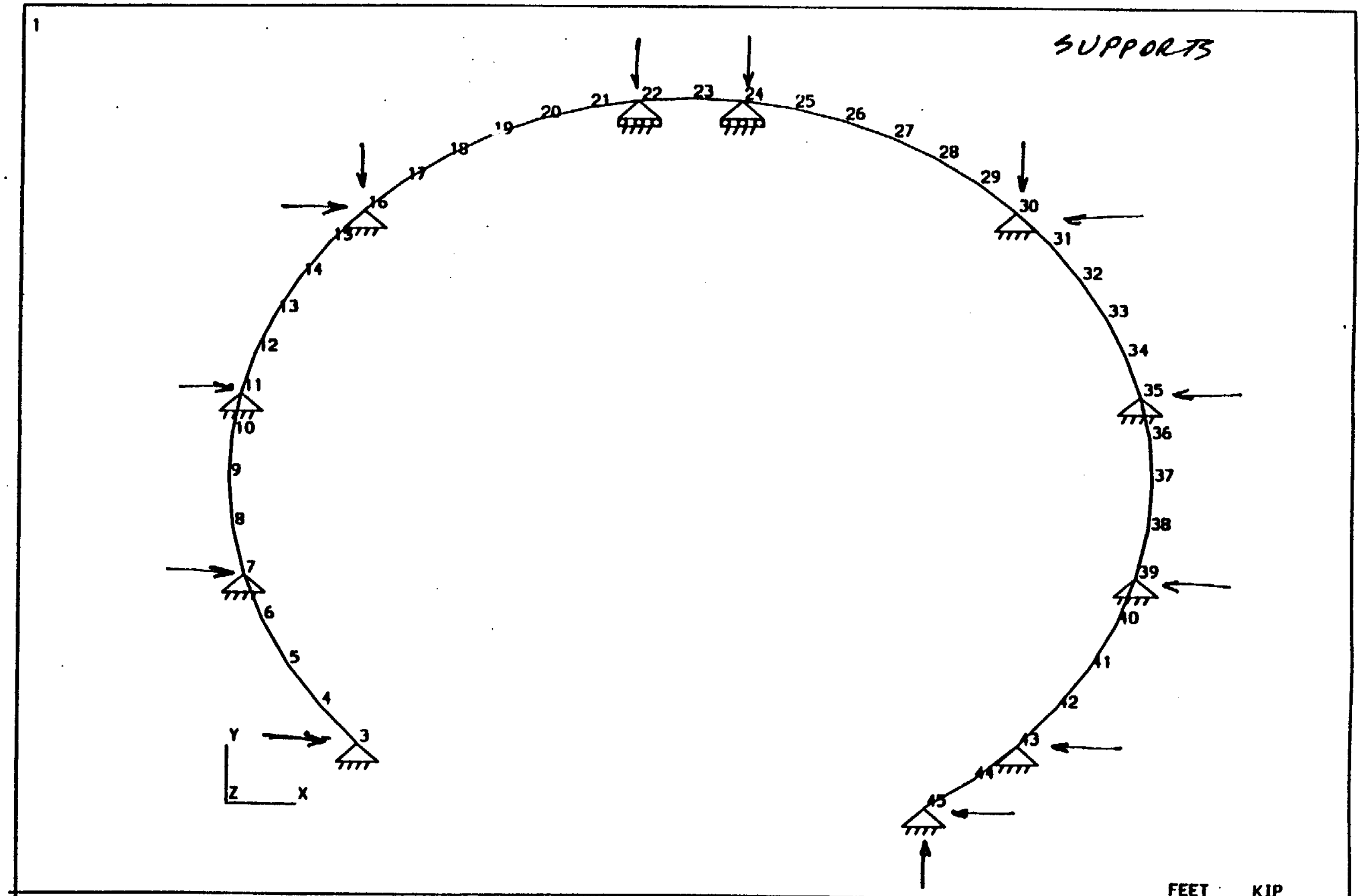
MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.035	3
		3.33 C	0.00	0.96	0.00
28	ST W8X 31	PASS	AISC- H1-3	0.033	3
		3.36 C	0.00	0.86	0.00
29	ST W8X 31	PASS	AISC- H1-3	0.027	3
		3.43 C	0.00	0.52	1.37
30	ST W8X 31	PASS	AISC- H2-1	0.016	3
		0.68 T	0.00	0.68	1.36
31	ST W8X 31	PASS	AISC- H2-1	0.016	3
		0.69 T	0.00	-0.68	0.00
32	ST W8X 31	PASS	AISC- H2-1	0.015	3
		0.59 T	0.00	-0.64	0.00
33	ST W8X 31	PASS	AISC- H2-1	0.010	3
		0.48 T	0.00	-0.43	0.00
34	ST W8X 31	PASS	SHEAR -Y	0.010	3
		0.25 T	0.00	-0.36	1.36
35	ST W8X 31	PASS	AISC- H2-1	0.007	3
		0.13 T	0.00	0.36	0.00
36	ST W8X 31	PASS	AISC- H2-1	0.004	3
		0.03 T	0.00	0.23	0.00
37	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.18 C	0.00	-0.03	1.56
38	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.28 C	0.00	-0.23	1.57
39	ST W8X 31	PASS	SHEAR -Y	0.007	3
		0.39 C	0.00	0.23	0.00
40	ST W8X 31	PASS	AISC- H1-3	0.007	3
		0.63 C	0.00	0.21	1.57
41	ST W8X 31	PASS	AISC- H1-3	0.007	3
		0.64 C	0.00	-0.21	0.00
42	ST W8X 31	PASS	AISC- H1-3	0.008	3
		0.81 C	0.00	-0.22	1.57
43	ST W8X 31	PASS	AISC- H1-3	0.012	3
		1.46 C	0.00	0.22	0.00
44	ST W8X 31	PASS	AISC- H1-3	0.010	3
		1.55 C	0.00	-0.12	0.00

*************** END OF TABULATED RESULT OF DESIGN ***************

49. PLOT DISPLACEMENT FILE
50. PLOT BENDING FILE
51. FINISH

**************** END OF STAAD-III ****************

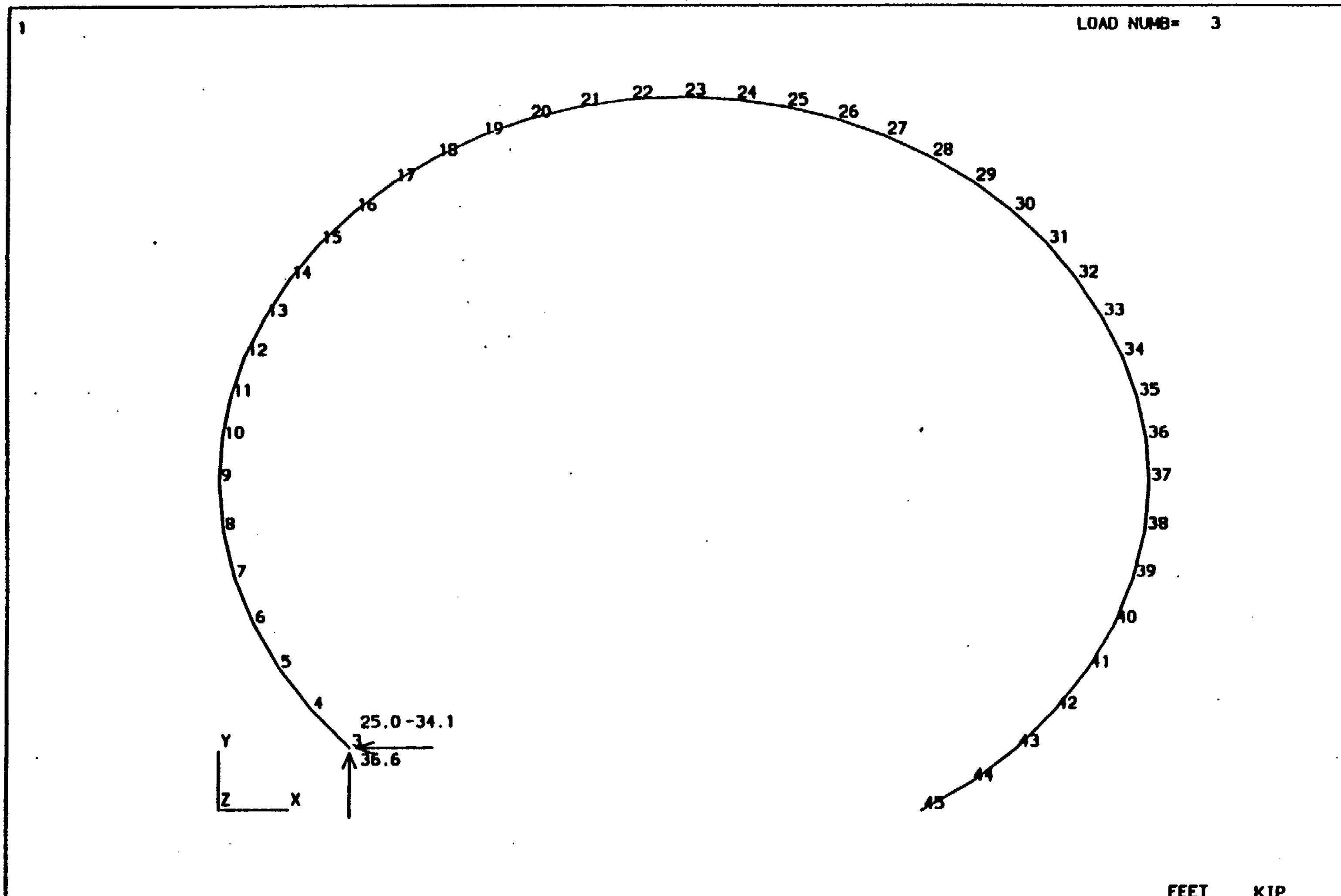
DATE= JUL 18,1995 TIME= 7:30:14 ******



S T A A D P L - P L O T (REVISION 16.0) STLRV4

COMPANY: M&O
DATE: APR 24, 1995

TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0



S T A A D P L - P L O T (REVISION 16.0) STLRV4

COMPANY: M&O
DATE: APR 24, 1995

TITLE: STAAD PLANE
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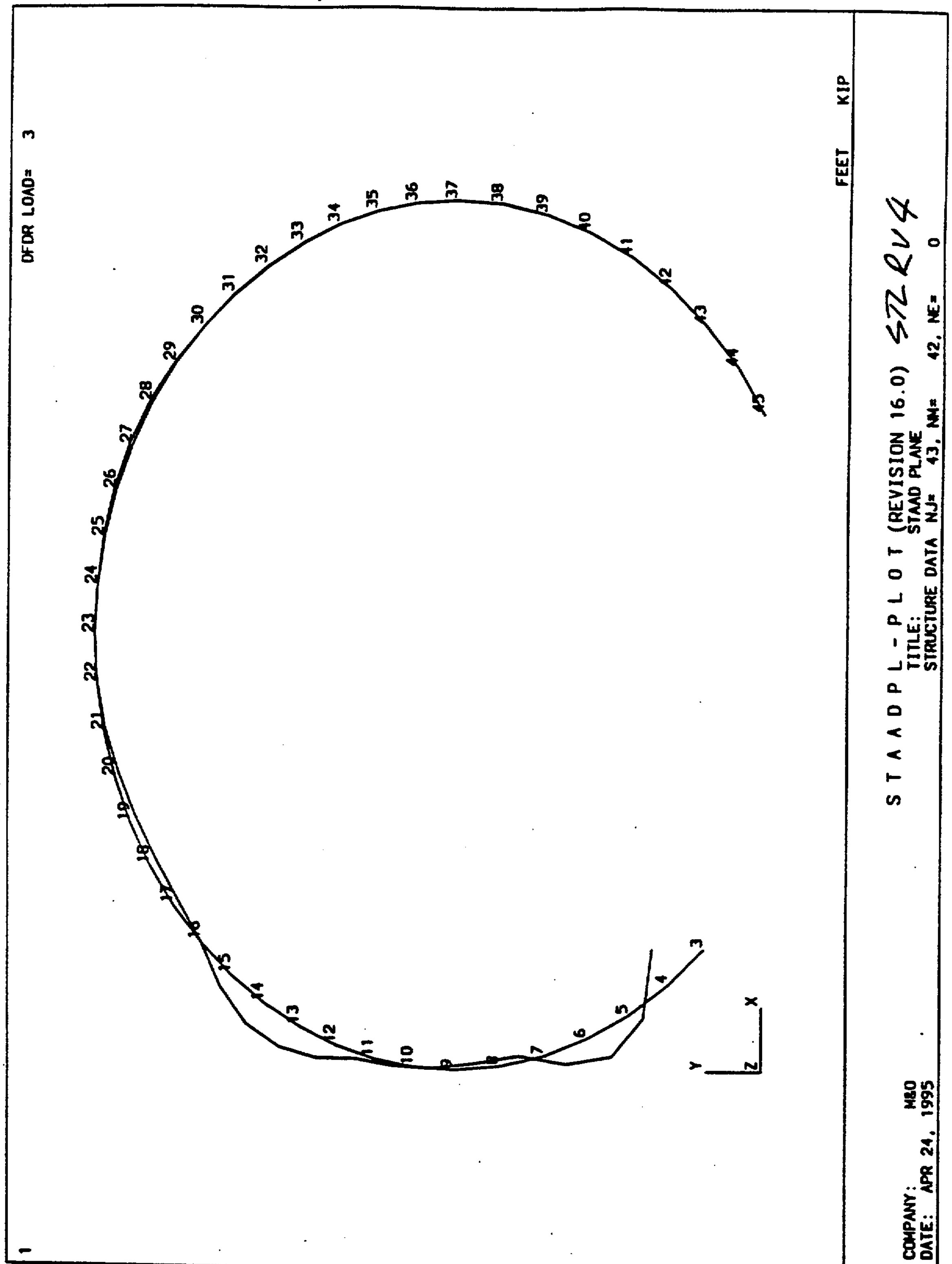
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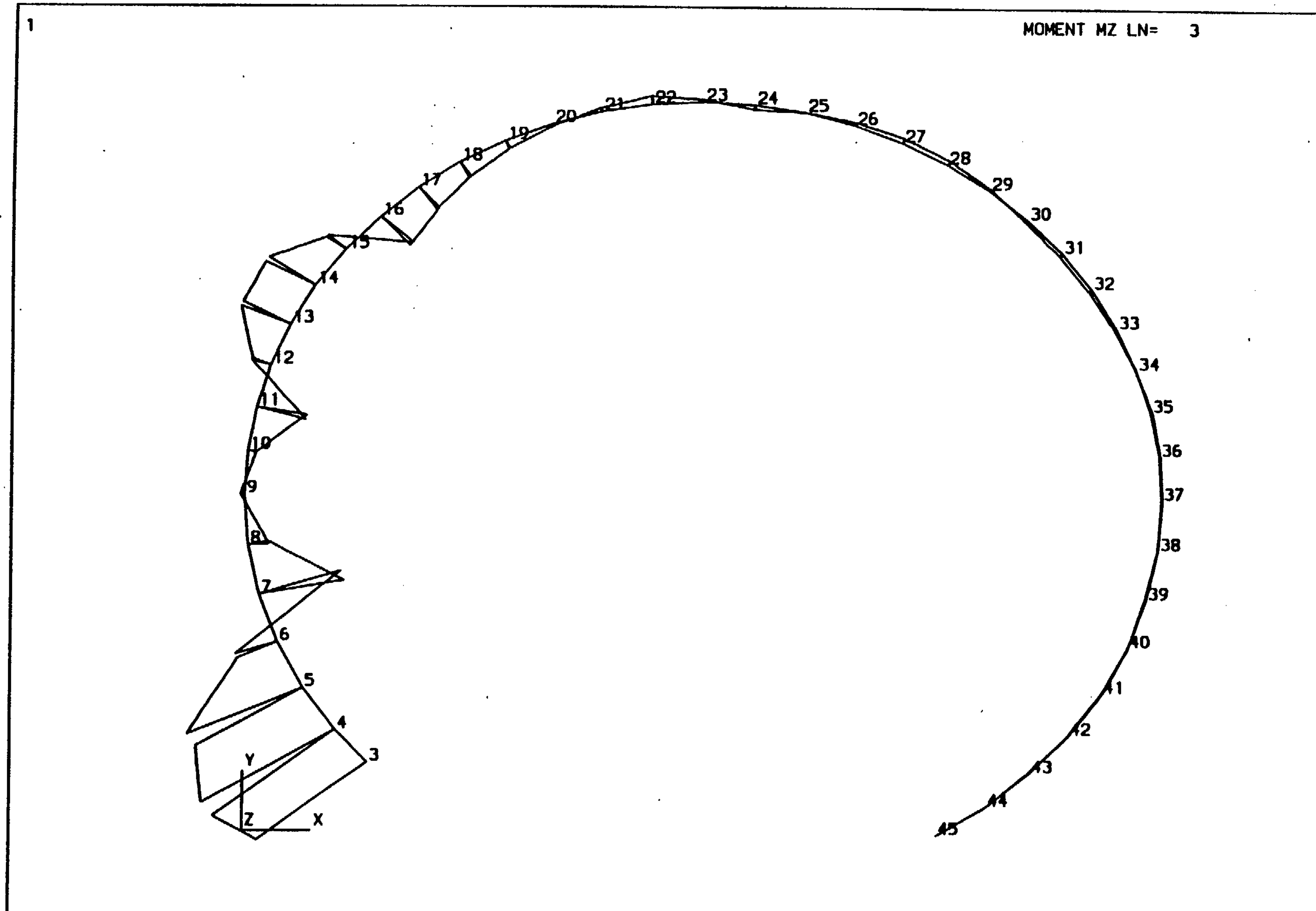
FEET KIP
STAADPL-PLOT (REVISION 16.0)
STZ RV4
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0
COMPANY: M&O
DATE: APR 24, 1995
X
Y
Z



S T A A D P L - P L O T (REVISION 16.0) STRV4

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT I
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

```
**************************************************
*                                                *
*            S T A A D - III                     *
*            Revision 16.0b                      *
*            Proprietary Program of              *
*            RESEARCH ENGINEERS, Inc.            *
*            Date=    JUL 18, 1995               *
*            Time=     7:58:50                   *
*                                                *
**************************************************

 1. STAAD PLANE  BABEE0000-01717-0200-00003  ATTACHMENT  I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. *
 4. * FILE STLRV4A
 5. * 25 TON JACK APPLIED ONE SIDE @ 49 DEGREES
 6. UNIT FT KIP
 7. JOINT COORDINATES
 8. 3 2.98 2.45 ; 4 2.43 3.13
 9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 20.88 1.94 ; 44 19.72 0.89
19. 45 18.43 0.00
20. MEMBER INCIDENCE
21. 3 3 4 44
22. UNIT KIP INCH
23. MEMBER PROPERTIES
24. 3 TO 44 TA STA W8X31
25. CONSTANTS
26. E 29000.0 ALL
27. DENSITY 0.00028 ALL
28. BETA 0 ALL
29. UNIT FT
30. SUPPORT
31. 3 7 11 35 39 43 FIXED BUT FY MZ
32. 22 24 FIXED BUT FX MZ
33. 16 30 45 PINNED
34. UNIT KIP
35. LOAD 1
36. SELF WEIGHT Y -1.0
37. LOADING 2
38. * 25 TON JACK & ONE SIDED JACKING
39. JOINT LOADING
40. 3 FX -32.80
41. 3 FY 37.74
42. 3 MZ 25.00
43. LOADING COMBINATION 3
44. 1 2.5 2 1.0
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P R O B L E M   S T A T I S T I C S
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NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     43/    42/    11
ORIGINAL/FINAL BAND-WIDTH =     1/     1
TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =     115
SIZE OF STIFFNESS MATRIX =      690 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =     0.08 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                     7:58:52
++ PROCESSING GLOBAL STIFFNESS MATRIX.                      7:58:53
++ PROCESSING TRIANGULAR FACTORIZATION.                     7:58:53
++ CALCULATING JOINT DISPLACEMENTS.                         7:58:54
++ CALCULATING MEMBER  FORCES.                              7:58:54

   46. LOAD LIST 3
   47. PRINT ANALYSIS RESULTS
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JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06126	0.00000	0.00000	0.00000	0.00306
4	3	-0.02016	0.04257	0.00000	0.00000	0.00000	0.00203
5	3	-0.03492	0.02905	0.00000	0.00000	0.00000	0.00030
6	3	-0.02348	0.03095	0.00000	0.00000	0.00000	-0.00079
7	3	0.00000	0.03557	0.00000	0.00000	0.00000	-0.00060
8	3	0.00097	0.03312	0.00000	0.00000	0.00000	-0.00002
9	3	-0.00074	0.03038	0.00000	0.00000	0.00000	0.00002
10	3	-0.00004	0.02805	0.00000	0.00000	0.00000	0.00003
11	3	0.00000	0.02575	0.00000	0.00000	0.00000	0.00037
12	3	-0.01379	0.02701	0.00000	0.00000	0.00000	0.00057
13	3	-0.02296	0.02807	0.00000	0.00000	0.00000	0.00017
14	3	-0.02241	0.02483	0.00000	0.00000	0.00000	-0.00045
15	3	-0.01268	0.01480	0.00000	0.00000	0.00000	-0.00090
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00079
17	3	0.00545	-0.00635	0.00000	0.00000	0.00000	-0.00036
18	3	0.00685	-0.00859	0.00000	0.00000	0.00000	-0.00007
19	3	0.00622	-0.00780	0.00000	0.00000	0.00000	0.00010
20	3	0.00498	-0.00526	0.00000	0.00000	0.00000	0.00017
21	3	0.00392	-0.00226	0.00000	0.00000	0.00000	0.00016
22	3	0.00335	0.00000	0.00000	0.00000	0.00000	0.00008
23	3	0.00314	0.00026	0.00000	0.00000	0.00000	0.00002
24	3	0.00294	0.00000	0.00000	0.00000	0.00000	0.00003
25	3	0.00296	0.00126	0.00000	0.00000	0.00000	0.00006
26	3	0.00309	0.00245	0.00000	0.00000	0.00000	0.00004
27	3	0.00307	0.00295	0.00000	0.00000	0.00000	-0.00001
28	3	0.00259	0.00252	0.00000	0.00000	0.00000	-0.00006
29	3	0.00151	0.00137	0.00000	0.00000	0.00000	-0.00010
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
31	3	-0.00094	-0.00091	0.00000	0.00000	0.00000	-0.00006
32	3	-0.00138	-0.00127	0.00000	0.00000	0.00000	-0.00001
33	3	-0.00125	-0.00123	0.00000	0.00000	0.00000	0.00002
34	3	-0.00069	-0.00103	0.00000	0.00000	0.00000	0.00004
35	3	0.00000	-0.00085	0.00000	0.00000	0.00000	0.00003
36	3	0.00023	-0.00081	0.00000	0.00000	0.00000	0.00001
37	3	0.00024	-0.00081	0.00000	0.00000	0.00000	0.00000
38	3	0.00010	-0.00079	0.00000	0.00000	0.00000	-0.00001
39	3	0.00000	-0.00076	0.00000	0.00000	0.00000	0.00000
40	3	0.00027	-0.00081	0.00000	0.00000	0.00000	0.00001
41	3	0.00041	-0.00083	0.00000	0.00000	0.00000	0.00000
42	3	0.00027	-0.00069	0.00000	0.00000	0.00000	-0.00001
43	3	0.00000	-0.00038	0.00000	0.00000	0.00000	-0.00001
44	3	0.00006	-0.00029	0.00000	0.00000	0.00000	-0.00001
45	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00001

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	4.97	0.00	0.00	0.00	0.00	0.00
7	3	27.95	0.00	0.00	0.00	0.00	0.00
11	3	20.34	0.00	0.00	0.00	0.00	0.00
35	3	0.48	0.00	0.00	0.00	0.00	0.00
39	3	-0.42	0.00	0.00	0.00	0.00	0.00
43	3	-0.94	0.00	0.00	0.00	0.00	0.00
22	3	0.00	1.26	0.00	0.00	0.00	0.00
24	3	0.00	-2.10	0.00	0.00	0.00	0.00
16	3	-17.43	-35.89	0.00	0.00	0.00	0.00
30	3	-3.43	2.52	0.00	0.00	0.00	0.00
45	3	1.27	1.03	0.00	0.00	0.00	0.00

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	46.85	2.09	0.00	0.00	0.00	-25.00
		4	-46.79	-2.05	0.00	0.00	0.00	26.81
4	3	4	46.75	-2.84	0.00	0.00	0.00	-26.81
		5	-46.65	2.91	0.00	0.00	0.00	22.32
5	3	5	45.91	-8.76	0.00	0.00	0.00	-22.32
		6	-45.81	8.81	0.00	0.00	0.00	8.58
6	3	6	44.37	-14.39	0.00	0.00	0.00	-8.58
		7	-44.26	14.42	0.00	0.00	0.00	-13.93
7	3	7	36.60	7.25	0.00	0.00	0.00	13.93
		8	-36.48	-7.23	0.00	0.00	0.00	-2.56
8	3	8	37.11	2.50	0.00	0.00	0.00	2.56
		9	-36.99	-2.49	0.00	0.00	0.00	1.34
9	3	9	37.02	2.06	0.00	0.00	0.00	1.34
		10	-36.91	-2.05	0.00	0.00	0.00	1.46
10	3	10	36.46	6.09	0.00	0.00	0.00	-1.46
		11	-36.36	-6.07	0.00	0.00	0.00	9.78
11	3	11	41.04	-9.67	0.00	0.00	0.00	-9.78
		12	-40.94	9.70	0.00	0.00	0.00	-3.41
12	3	12	41.82	-4.61	0.00	0.00	0.00	3.41
		13	-41.72	4.65	0.00	0.00	0.00	-9.74
13	3	13	41.98	-0.39	0.00	0.00	0.00	9.74
		14	-41.89	0.44	0.00	0.00	0.00	-10.30
14	3	14	41.66	4.34	0.00	0.00	0.00	10.30
		15	-41.58	-4.28	0.00	0.00	0.00	-4.38
15	3	15	40.77	9.19	0.00	0.00	0.00	4.38
		16	-40.70	-9.12	0.00	0.00	0.00	8.07
16	3	16	2.56	-1.68	0.00	0.00	0.00	-8.07
		17	-2.49	1.76	0.00	0.00	0.00	5.71
17	3	17	2.67	-1.48	0.00	0.00	0.00	-5.71
		18	-2.61	1.56	0.00	0.00	0.00	3.64
8	3	18	2.77	-1.25	0.00	0.00	0.00	-3.64
		19	-2.72	1.34	0.00	0.00	0.00	1.86

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	2.85	-1.03	0.00	0.00	0.00	-1.86
		20	-2.81	1.13	0.00	0.00	0.00	0.39
20	3	20	2.92	-0.82	0.00	0.00	0.00	-0.39
		21	-2.89	0.92	0.00	0.00	0.00	-0.79
21	3	21	2.98	-0.59	0.00	0.00	0.00	0.79
		22	-2.96	0.69	0.00	0.00	0.00	-1.66
22	3	22	3.09	0.90	0.00	0.00	0.00	1.66
		23	-3.08	-0.80	0.00	0.00	0.00	-0.49
23	3	23	2.97	1.15	0.00	0.00	0.00	0.49
		24	-2.98	-1.05	0.00	0.00	0.00	1.01
24	3	24	3.20	-0.70	0.00	0.00	0.00	-1.01
		25	-3.21	0.80	0.00	0.00	0.00	-0.01
25	3	25	3.28	-0.44	0.00	0.00	0.00	0.01
		26	-3.31	0.54	0.00	0.00	0.00	-0.67
26	3	26	3.35	-0.18	0.00	0.00	0.00	0.67
		27	-3.39	0.28	0.00	0.00	0.00	-0.99
27	3	27	3.40	0.12	0.00	0.00	0.00	0.99
		28	-3.45	-0.03	0.00	0.00	0.00	-0.88
28	3	28	3.43	0.42	0.00	0.00	0.00	0.88
		29	-3.49	-0.33	0.00	0.00	0.00	-0.37
29	3	29	3.43	0.71	0.00	0.00	0.00	0.37
		30	-3.50	-0.63	0.00	0.00	0.00	0.54
30	3	30	-0.76	0.15	0.00	0.00	0.00	-0.54
		31	0.68	-0.08	0.00	0.00	0.00	0.70
31	3	31	-0.69	-0.01	0.00	0.00	0.00	-0.70
		32	0.60	0.07	0.00	0.00	0.00	0.65
32	3	32	-0.59	-0.13	0.00	0.00	0.00	-0.65
		33	0.50	0.18	0.00	0.00	0.00	0.44
33	3	33	-0.47	-0.24	0.00	0.00	0.00	-0.44
		34	0.38	0.28	0.00	0.00	0.00	0.09
4	3	34	-0.35	-0.32	0.00	0.00	0.00	-0.09
		35	0.24	0.34	0.00	0.00	0.00	-0.36
35	3	35	-0.12	0.11	0.00	0.00	0.00	0.36
		36	0.02	-0.09	0.00	0.00	0.00	-0.23

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	-0.03	0.09	0.00	0.00	0.00	0.23
		37	-0.07	-0.08	0.00	0.00	0.00	-0.12
37	3	37	0.07	-0.09	0.00	0.00	0.00	-0.12
		38	-0.18	0.10	0.00	0.00	0.00	-0.03
38	3	38	0.17	-0.12	0.00	0.00	0.00	0.03
		39	-0.29	0.14	0.00	0.00	0.00	-0.23
39	3	39	0.40	0.22	0.00	0.00	0.00	0.23
		40	-0.51	-0.18	0.00	0.00	0.00	0.08
40	3	40	0.53	0.11	0.00	0.00	0.00	-0.08
		41	-0.64	-0.06	0.00	0.00	0.00	0.21
41	3	41	0.64	-0.02	0.00	0.00	0.00	-0.21
		42	-0.74	0.09	0.00	0.00	0.00	0.13
42	3	42	0.73	-0.18	0.00	0.00	0.00	-0.13
		43	-0.82	0.26	0.00	0.00	0.00	-0.22
43	3	43	1.47	0.27	0.00	0.00	0.00	0.22
		44	-1.55	-0.18	0.00	0.00	0.00	0.12
44	3	44	1.56	-0.03	0.00	0.00	0.00	-0.12
		45	-1.63	0.13	0.00	0.00	0.00	0.00

************** END OF LATEST ANALYSIS RESULT **************

48. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.730	3
		46.79 C	0.00	26.81	0.87
4	ST W8X 31	PASS	AISC- H1-2	0.730	3
		46.75 C	0.00	-26.81	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.643	3
		45.91 C	0.00	-22.32	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.480	3
		44.26 C	0.00	-13.93	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.441	3
		36.60 C	0.00	13.93	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.235	3
		37.11 C	0.00	2.56	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.214	3
		36.91 C	0.00	1.46	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.364	3
		36.36 C	0.00	9.78	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.388	3
		41.04 C	0.00	-9.78	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.390	3
		41.72 C	0.00	-9.74	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.401	3
		41.89 C	0.00	-10.30	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.400	3
		41.66 C	0.00	10.30	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.355	3
		40.70 C	0.00	8.07	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.161	3
		2.56 C	0.00	-8.07	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.119	3
		2.67 C	0.00	-5.71	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.081	3
		2.77 C	0.00	-3.64	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.049	3
		2.85 C	0.00	-1.86	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.029	3
		2.89 C	0.00	-0.79	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.046	3
		2.96 C	0.00	-1.66	1.36
22	ST W8X 31	PASS	AISC- H1-3	0.046	3
		3.09 C	0.00	1.66	0.00
23	ST W8X 31	PASS	SHEAR -Y	0.035	3
		2.97 C	0.00	0.49	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.035	3
		3.20 C	0.00	-1.01	0.00
25	ST W8X 31	PASS	AISC- H1-3	0.029	3
		3.31 C	0.00	-0.67	1.36
26	ST W8X 31	PASS	AISC- H1-3	0.036	3
		3.39 C	0.00	-0.99	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

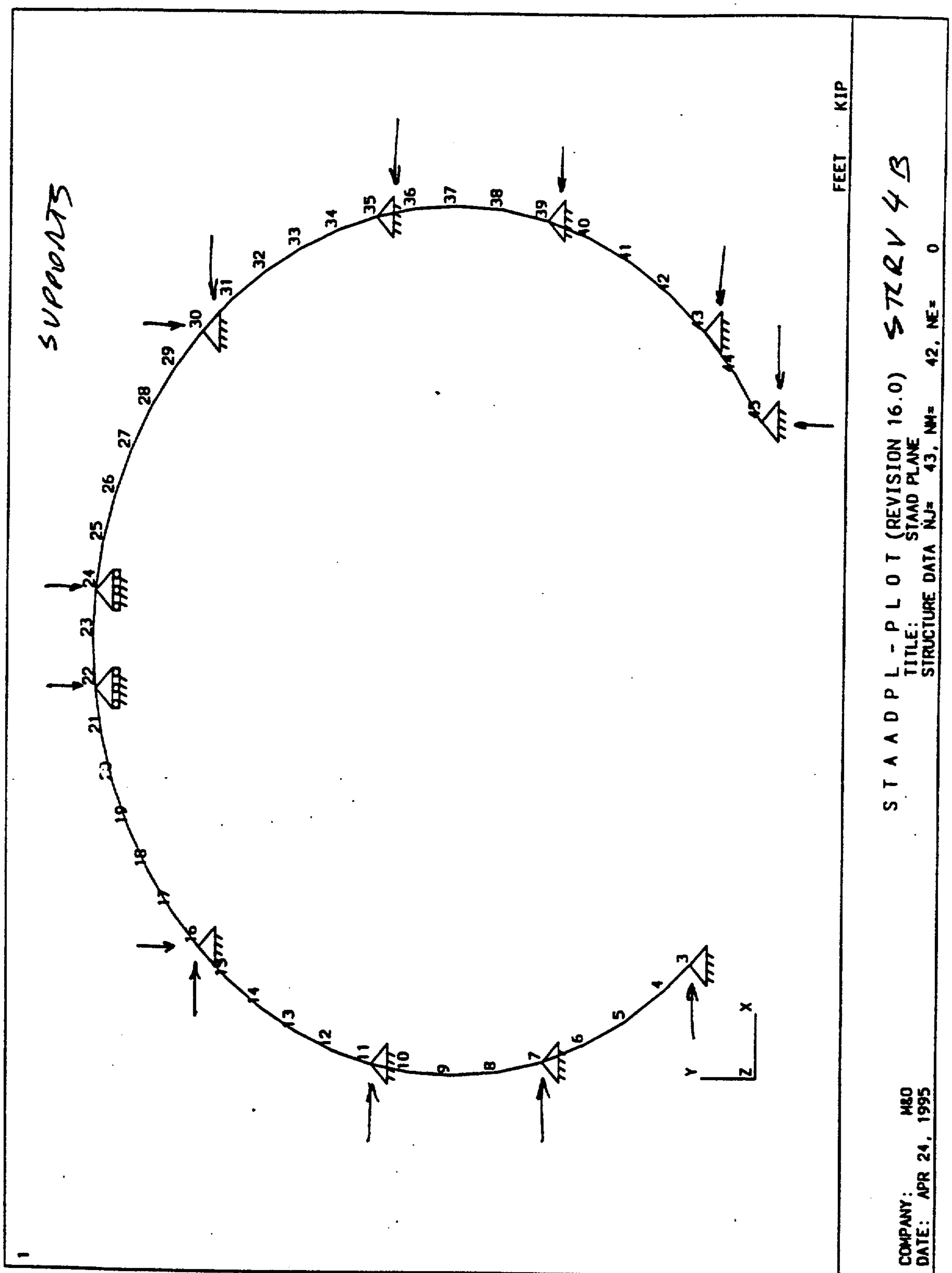
MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.036	3
		3.40 C	0.00	0.99	0.00
28	ST W8X 31	PASS	AISC- H1-3	0.034	3
		3.43 C	0.00	0.88	0.00
29	ST W8X 1	PASS	AISC- H1-3	0.028	3
		3.50 C	0.00	0.54	1.37
30	ST W8X 31	PASS	AISC- H2-1	0.016	3
		0.68 T	0.00	0.70	1.36
31	ST W8X 31	PASS	AISC- H2-1	0.016	3
		0.69 T	0.00	-0.70	0.00
32	ST W8X 31	PASS	AISC- H2-1	0.015	3
		0.59 T	0.00	-0.65	0.00
33	ST W8X 31	PASS	AISC- H2-1	0.010	3
		0.47 T	0.00	-0.44	0.00
34	ST W8X 31	PASS	SHEAR -Y	0.011	3
		0.24 T	0.00	-0.36	1.36
35	ST W8X 31	PASS	AISC- H2-1	0.007	3
		0.12 T	0.00	0.36	0.00
36	ST W8X 31	PASS	AISC- H2-1	0.004	3
		0.03 T	0.00	0.23	0.00
37	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.18 C	0.00	-0.03	1.56
38	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.29 C	0.00	-0.23	1.57
39	ST W8X 31	PASS	SHEAR -Y	0.007	3
		0.40 C	0.00	0.23	0.00
40	ST W8X 31	PASS	AISC- H1-3	0.007	3
		0.64 C	0.00	0.21	1.57
41	ST W8X 31	PASS	AISC- H1-3	0.007	3
		0.64 C	0.00	-0.21	0.00
42	ST W8X 31	PASS	AISC- H1-3	0.008	3
		0.82 C	0.00	-0.22	1.57
43	ST W8X 31	PASS	AISC- H1-3	0.012	3
		1.47 C	0.00	0.22	0.00
44	ST W8X 31	PASS	AISC- H1-3	0.010	3
		1.56 C	0.00	-0.12	0.00

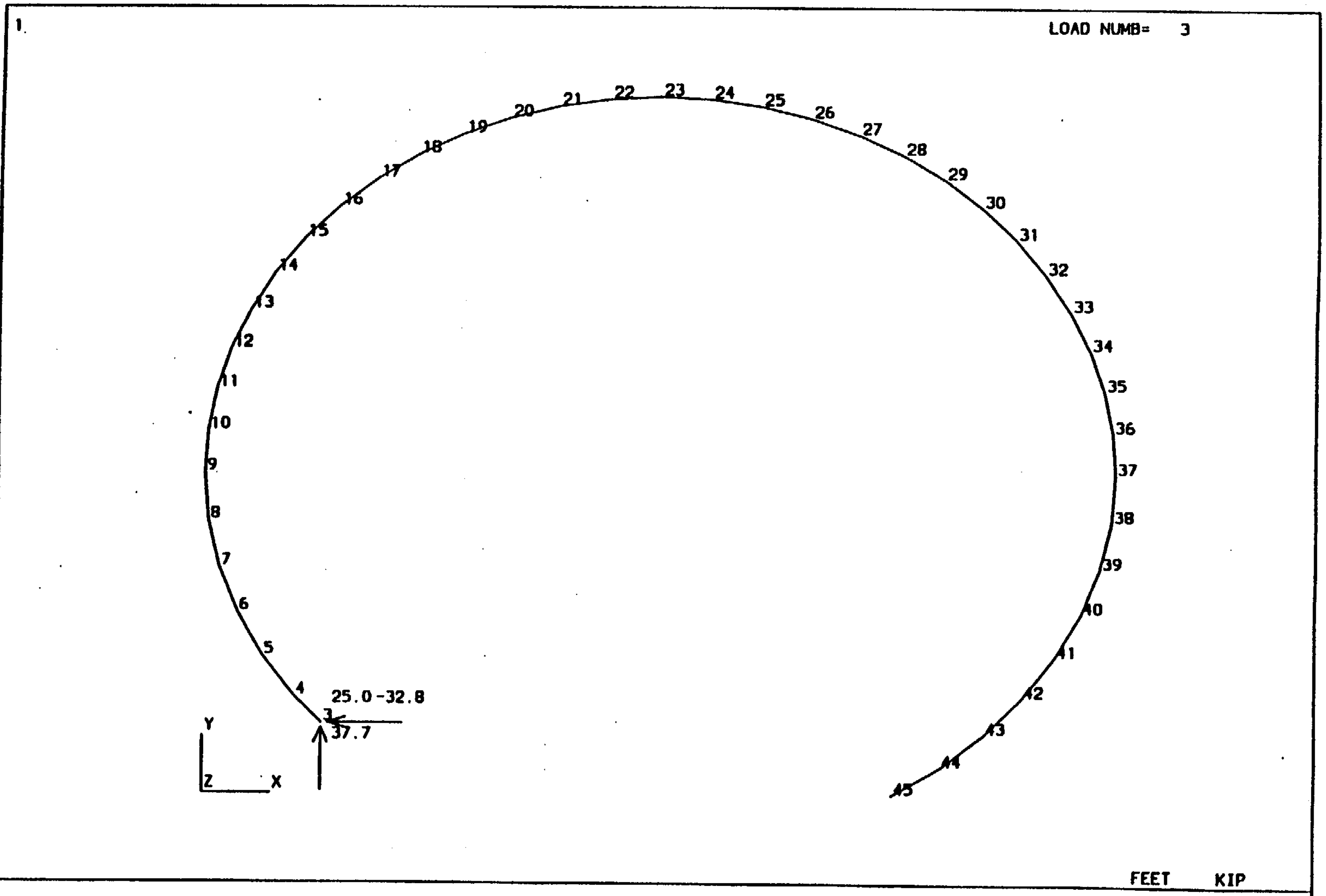
************** END OF TABULATED RESULT OF DESIGN **************

49. PLOT DISPLACEMENT FILE
50. PLOT BENDING FILE
51. FINISH

*************** END OF STAAD-III **************

DATE= JUL 18,1995 TIME= 7:58:58 ******

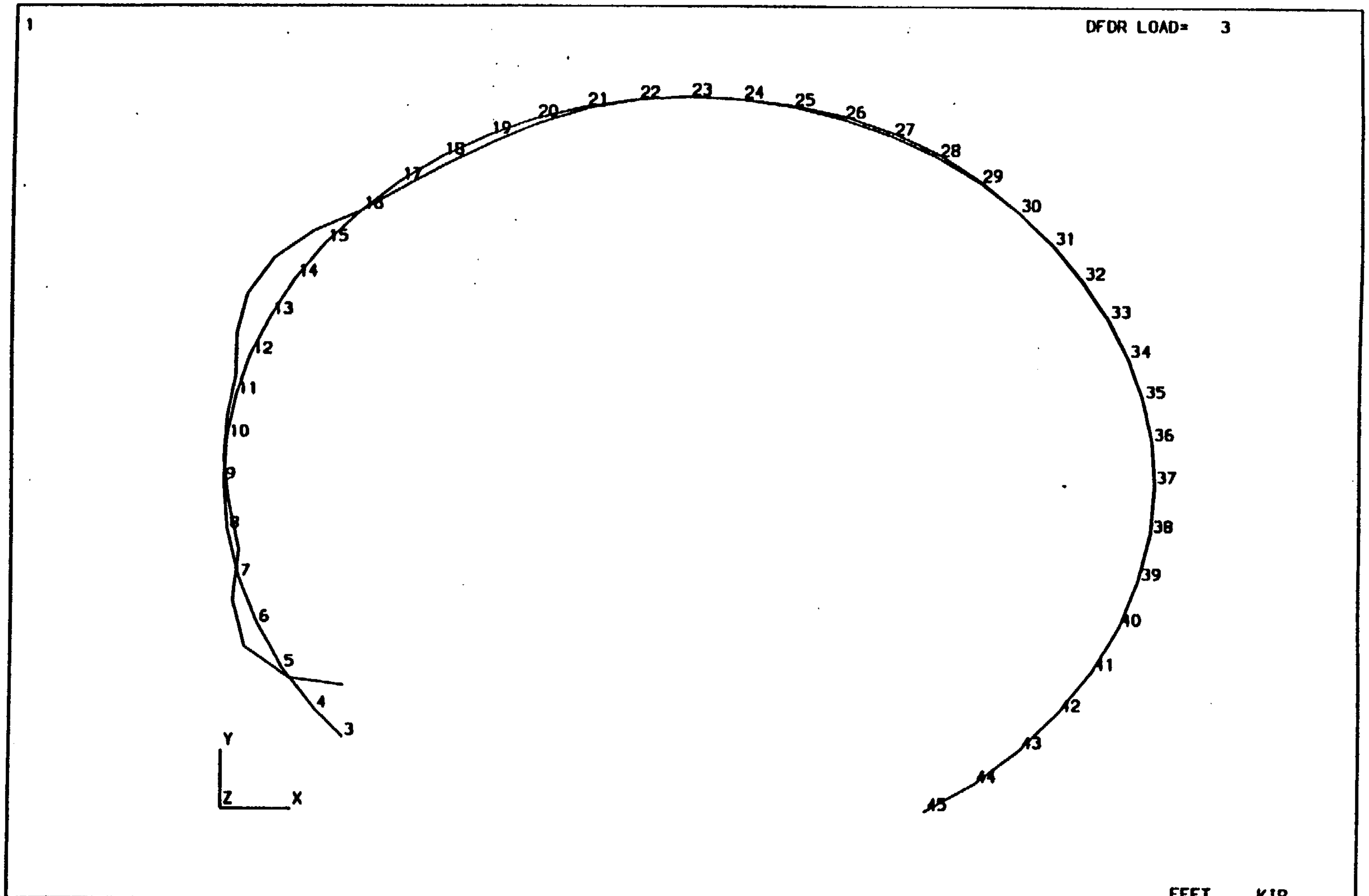

SUPPORTS
STRV 4B
FEET KIP
S T A A D P L - P L O T (REVISION 16.0)
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0
COMPANY: M&O
DATE: APR 24, 1995



STAADPL-PLOT (REVISION 16.0) STZR1/4A

COMPANY: M&O
DATE: APR 24, 1995

TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

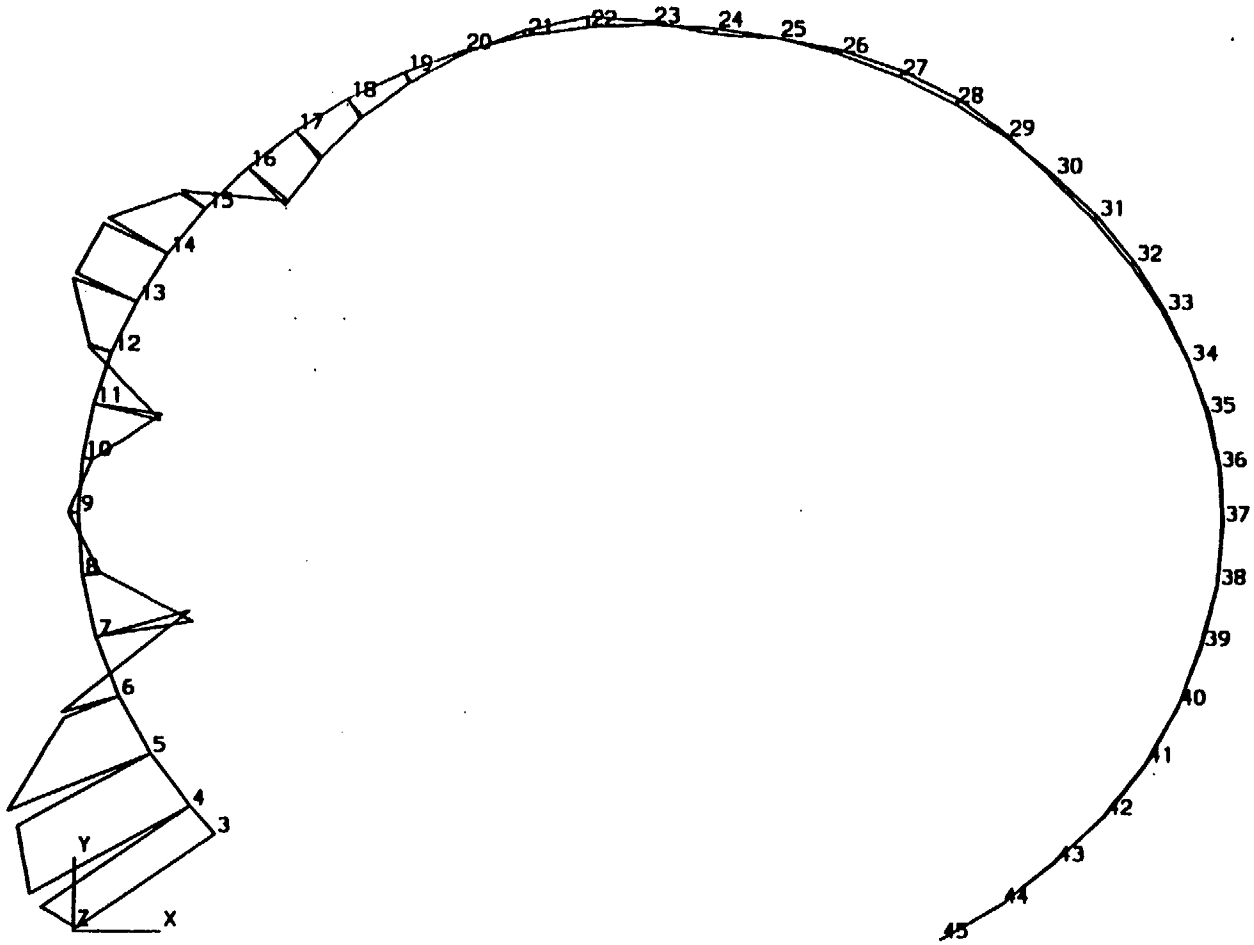


COMPANY: M&O
DATE: APR 24, 1995

S T A A D P L - P L O T (REVISION 16.0) STZRV4A
TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

1

MOMENT MZ LN= 3



FEET KIP

COMPANY: M&O
DATE: JUL 18, 1995

S T A A D P L - P L O T (REVISION 16.0) STZRV 4A
TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

```
**************************************************
*                                                *
*              S T A A D - III                   *
*              Revision 16.0b                    *
*              Proprietary Program of            *
*              RESEARCH ENGINEERS, Inc.          *
*              Date=    JUL 18, 1995             *
*              Time=     8:26:52                 *
*                                                *
**************************************************

 1. STAAD PLANE  BABEE0000-01717-0200-00003  ATTACHMENT  I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. *
 4. * FILE STLRV4B
 5. * 25 TON JACK APPLIED ONE SIDE @ 51 DEGREES
 6. UNIT FT KIP
 7. JOINT COORDINATES
 8. 3 2.71 2.77 ; 4 2.43 3.13
 9. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
10. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
11. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
12. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
13. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
14. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
15. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
16. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
17. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
18. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 20.88 1.94 ; 44 19.72 0.89
19. 45 18.43 0.00
20. MEMBER INCIDENCE
21. 3 3 4 44
22. UNIT KIP INCH
23. MEMBER PROPERTIES
24. 3 TO 44 TA STA W8X31
25. CONSTANTS
26. E 29000.0 ALL
27. DENSITY 0.00028 ALL
28. BETA 0 ALL
29. UNIT FT
30. SUPPORT
31. 3 7 11 35 39 43 FIXED BUT FY MZ
32. 22 24 FIXED BUT FX MZ
33. 16 30 45 PINNED
34. UNIT KIP
35. LOAD 1
36. SELF WEIGHT Y -1.0
37. LOADING 2
38. * 25 TON JACK & ONE SIDED JACKING
39. JOINT LOADING
40. 3 FX -31.47
41. 3 FY 38.86
42. 3 MZ 25.00
43. LOADING COMBINATION 3
44. 1 2.5 2 1.0
```

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     P R O B L E M   S T A T I S T I C S
     -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     43/    42/    11
  ORIGINAL/FINAL BAND-WIDTH =     1/     1
  TOTAL PRIMARY LOAD CASES  =     2, TOTAL DEGREES OF FREEDOM =    115
  SIZE OF STIFFNESS MATRIX =      690 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =     0.08 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                       8:26:55
++ PROCESSING GLOBAL STIFFNESS MATRIX.                        8:26:55
++ PROCESSING TRIANGULAR FACTORIZATION.                       8:26:56
++ CALCULATING JOINT DISPLACEMENTS.                           8:26:56
++ CALCULATING MEMBER  FORCES.                                8:26:56

 46. LOAD LIST 3
 47. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.05839	0.00000	0.00000	0.00000	0.00273
4	3	-0.01030	0.04913	0.00000	0.00000	0.00000	0.00221
5	3	-0.02838	0.03337	0.00000	0.00000	0.00000	0.00051
6	3	-0.02056	0.03345	0.00000	0.00000	0.00000	-0.00061
7	3	0.00000	0.03700	0.00000	0.00000	0.00000	-0.00048
8	3	-0.00043	0.03418	0.00000	0.00000	0.00000	0.00002
9	3	-0.00218	0.03135	0.00000	0.00000	0.00000	0.00001
10	3	-0.00080	0.02892	0.00000	0.00000	0.00000	-0.00001
11	3	0.00000	0.02642	0.00000	0.00000	0.00000	0.00036
12	3	-0.01392	0.02764	0.00000	0.00000	0.00000	0.00058
13	3	-0.02333	0.02870	0.00000	0.00000	0.00000	0.00017
14	3	-0.02285	0.02541	0.00000	0.00000	0.00000	-0.00045
15	3	-0.01295	0.01516	0.00000	0.00000	0.00000	-0.00092
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00080
17	3	0.00557	-0.00649	0.00000	0.00000	0.00000	-0.00037
18	3	0.00700	-0.00877	0.00000	0.00000	0.00000	-0.00007
19	3	0.00635	-0.00796	0.00000	0.00000	0.00000	0.00010
20	3	0.00509	-0.00536	0.00000	0.00000	0.00000	0.00017
21	3	0.00401	-0.00230	0.00000	0.00000	0.00000	0.00016
22	3	0.00342	0.00000	0.00000	0.00000	0.00000	0.00008
23	3	0.00321	0.00027	0.00000	0.00000	0.00000	0.00002
24	3	0.00301	0.00000	0.00000	0.00000	0.00000	0.00003
25	3	0.00303	0.00129	0.00000	0.00000	0.00000	0.00003
26	3	0.00316	0.00252	0.00000	0.00000	0.00000	0.00007
27	3	0.00314	0.00303	0.00000	0.00000	0.00000	0.00005
28	3	0.00265	0.00258	0.00000	0.00000	0.00000	-0.00001
29	3	0.00154	0.00140	0.00000	0.00000	0.00000	-0.00006
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
31	3	-0.00096	-0.00092	0.00000	0.00000	0.00000	-0.00010
32	3	-0.00140	-0.00128	0.00000	0.00000	0.00000	-0.00006
33	3	-0.00127	-0.00125	0.00000	0.00000	0.00000	-0.00001
34	3	-0.00070	-0.00104	0.00000	0.00000	0.00000	0.00002
35	3	0.00000	-0.00086	0.00000	0.00000	0.00000	0.00004
36	3	0.00023	-0.00082	0.00000	0.00000	0.00000	0.00003
37	3	0.00024	-0.00082	0.00000	0.00000	0.00000	0.00001
38	3	0.00011	-0.00080	0.00000	0.00000	0.00000	0.00000
39	3	0.00000	-0.00076	0.00000	0.00000	0.00000	-0.00001
40	3	0.00027	-0.00082	0.00000	0.00000	0.00000	0.00000
41	3	0.00041	-0.00084	0.00000	0.00000	0.00000	0.00001
42	3	0.00027	-0.00069	0.00000	0.00000	0.00000	0.00000
43	3	0.00000	-0.00038	0.00000	0.00000	0.00000	-0.00001
44	3	0.00006	-0.00029	0.00000	0.00000	0.00000	-0.00001
45	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00001

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	3.60	0.00	0.00	0.00	0.00	0.00
7	3	27.66	0.00	0.00	0.00	0.00	0.00
11	3	21.39	0.00	0.00	0.00	0.00	0.00
35	3	0.49	0.00	0.00	0.00	0.00	0.00
39	3	-0.42	0.00	0.00	0.00	0.00	0.00
43	3	-0.94	0.00	0.00	0.00	0.00	0.00
22	3	0.00	1.28	0.00	0.00	0.00	0.00
24	3	0.00	-2.15	0.00	0.00	0.00	0.00
16	3	-18.09	-37.04	0.00	0.00	0.00	0.00
30	3	-3.49	2.54	0.00	0.00	0.00	0.00
45	3	1.28	1.04	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	47.79	1.86	0.00	0.00	0.00	-25.00
		4	-47.76	-1.83	0.00	0.00	0.00	25.84
4	3	4	47.74	-2.25	0.00	0.00	0.00	-25.84
		5	-47.64	2.31	0.00	0.00	0.00	22.28
5	3	5	46.97	-8.29	0.00	0.00	0.00	-22.28
		6	-46.86	8.34	0.00	0.00	0.00	9.26
6	3	6	45.48	-14.06	0.00	0.00	0.00	-9.26
		7	-45.36	14.10	0.00	0.00	0.00	-12.73
7	3	7	37.80	7.15	0.00	0.00	0.00	12.73
		8	-37.68	-7.12	0.00	0.00	0.00	-1.54
8	3	8	38.28	2.24	0.00	0.00	0.00	1.54
		9	-38.16	-2.23	0.00	0.00	0.00	1.95
9	3	9	38.15	2.46	0.00	0.00	0.00	1.95
		10	-38.04	-2.45	0.00	0.00	0.00	1.39
10	3	10	37.54	6.61	0.00	0.00	0.00	-1.39
		11	-37.44	-6.60	0.00	0.00	0.00	10.44
11	3	11	42.34	-10.05	0.00	0.00	0.00	-10.44
		12	-42.24	10.08	0.00	0.00	0.00	-3.26
12	3	12	43.16	-4.82	0.00	0.00	0.00	3.26
		13	-43.06	4.86	0.00	0.00	0.00	-9.88
13	3	13	43.33	-0.46	0.00	0.00	0.00	9.88
		14	-43.24	0.51	0.00	0.00	0.00	-10.55
14	3	14	43.02	4.42	0.00	0.00	0.00	10.55
		15	-42.93	-4.36	0.00	0.00	0.00	-4.52
15	3	15	42.11	9.43	0.00	0.00	0.00	4.52
		16	-42.03	-9.36	0.00	0.00	0.00	8.25
16	3	16	2.61	-1.72	0.00	0.00	0.00	-8.25
		17	-2.54	1.80	0.00	0.00	0.00	5.84
17	3	17	2.72	-1.51	0.00	0.00	0.00	-5.84
		18	-2.66	1.60	0.00	0.00	0.00	3.72
18	3	18	2.83	-1.28	0.00	0.00	0.00	-3.72
		19	-2.77	1.37	0.00	0.00	0.00	1.90

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	2.91	-1.06	0.00	0.00	0.00	-1.90
		20	-2.87	1.15	0.00	0.00	0.00	0.40
20	3	20	2.98	-0.83	0.00	0.00	0.00	-0.40
		21	-2.95	0.93	0.00	0.00	0.00	-0.81
21	3	21	3.04	-0.60	0.00	0.00	0.00	0.81
		22	-3.02	0.70	0.00	0.00	0.00	-1.69
22	3	22	3.15	0.92	0.00	0.00	0.00	1.69
		23	-3.15	-0.82	0.00	0.00	0.00	-0.50
23	3	23	3.03	1.18	0.00	0.00	0.00	0.50
		24	-3.04	-1.08	0.00	0.00	0.00	1.04
24	3	24	3.26	-0.72	0.00	0.00	0.00	-1.04
		25	-3.28	0.82	0.00	0.00	0.00	-0.01
25	3	25	3.35	-0.45	0.00	0.00	0.00	0.01
		26	-3.38	0.55	0.00	0.00	0.00	-0.69
26	3	26	3.42	-0.19	0.00	0.00	0.00	0.69
		27	-3.46	0.28	0.00	0.00	0.00	-1.01
27	3	27	3.47	0.12	0.00	0.00	0.00	1.01
		28	-3.52	-0.03	0.00	0.00	0.00	-0.90
28	3	28	3.49	0.43	0.00	0.00	0.00	0.90
		29	-3.55	-0.34	0.00	0.00	0.00	-0.38
29	3	29	3.49	0.73	0.00	0.00	0.00	0.38
		30	-3.56	-0.65	0.00	0.00	0.00	0.56
30	3	30	-0.76	0.14	0.00	0.00	0.00	-0.56
		31	0.68	-0.07	0.00	0.00	0.00	0.71
31	3	31	-0.68	-0.01	0.00	0.00	0.00	-0.71
		32	0.60	0.07	0.00	0.00	0.00	0.66
32	3	32	-0.59	-0.13	0.00	0.00	0.00	-0.66
		33	0.49	0.18	0.00	0.00	0.00	0.44
33	3	33	-0.47	-0.24	0.00	0.00	0.00	-0.44
		34	0.37	0.28	0.00	0.00	0.00	0.09
34	3	34	-0.34	-0.32	0.00	0.00	0.00	-0.09
		35	0.24	0.35	0.00	0.00	0.00	-0.37
35	3	35	-0.12	0.11	0.00	0.00	0.00	0.37
		36	0.01	-0.09	0.00	0.00	0.00	-0.23

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	-0.02	0.09	0.00	0.00	0.00	0.23
		37	-0.08	-0.08	0.00	0.00	0.00	-0.12
37	3	37	0.07	-0.09	0.00	0.00	0.00	-0.12
		38	-0.19	0.10	0.00	0.00	0.00	-0.03
38	3	38	0.18	-0.12	0.00	0.00	0.00	0.03
		39	-0.29	0.14	0.00	0.00	0.00	-0.24
39	3	39	0.41	0.22	0.00	0.00	0.00	0.24
		40	-0.52	-0.18	0.00	0.00	0.00	0.08
40	3	40	0.54	0.11	0.00	0.00	0.00	-0.08
		41	-0.65	-0.06	0.00	0.00	0.00	0.21
41	3	41	0.65	-0.02	0.00	0.00	0.00	-0.21
		42	-0.75	0.09	0.00	0.00	0.00	0.13
42	3	42	0.73	-0.18	0.00	0.00	0.00	-0.13
		43	-0.82	0.26	0.00	0.00	0.00	-0.22
43	3	43	1.48	0.27	0.00	0.00	0.00	0.22
		44	-1.56	-0.18	0.00	0.00	0.00	0.12
44	3	44	1.57	-0.03	0.00	0.00	0.00	-0.12
		45	-1.64	0.13	0.00	0.00	0.00	0.00

************** END OF LATEST ANALYSIS RESULT **************

48. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.717	3
		47.76 C	0.00	25.84	0.46
4	ST W8X 31	PASS	AISC- H1-2	0.717	3
		47.74 C	0.00	-25.84	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.647	3
		46.97 C	0.00	-22.28	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.464	3
		45.36 C	0.00	-12.73	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.426	3
		37.80 C	0.00	12.73	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.229	3
		38.16 C	0.00	1.95	1.56
9	ST W8X 31	PASS	AISC- H1-2	0.229	3
		38.15 C	0.00	1.95	0.00
10	ST W8X 31	PASS	AISC- H1-2	0.382	3
		37.44 C	0.00	10.44	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.406	3
		42.34 C	0.00	-10.44	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.400	3
		43.06 C	0.00	-9.88	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.413	3
		43.24 C	0.00	-10.55	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.412	3
		43.02 C	0.00	10.55	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.365	3
		42.03 C	0.00	8.25	1.36
16	ST W8X 31	PASS	AISC- H1-3	0.165	3
		2.61 C	0.00	-8.25	0.00
17	ST W8X 31	PASS	AISC- H1-3	0.121	3
		2.72 C	0.00	-5.84	0.00
18	ST W8X 31	PASS	AISC- H1-3	0.083	3
		2.83 C	0.00	-3.72	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.050	3
		2.91 C	0.00	-1.90	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.030	3
		2.95 C	0.00	-0.81	1.36
21	ST W8X 31	PASS	AISC- H1-3	0.047	3
		3.02 C	0.00	-1.69	1.36
22	ST W8X 31	PASS	AISC- H1-3	0.047	3
		3.15 C	0.00	1.69	0.00
23	ST W8X 31	PASS	SHEAR -Y	0.036	3
		3.03 C	0.00	0.50	0.00
24	ST W8X 31	PASS	AISC- H1-3	0.036	3
		3.26 C	0.00	-1.04	0.00
25	ST W8X 31	PASS	AISC- H1-3	0.030	3
		3.38 C	0.00	-0.69	1.36
26	ST W8X 31	PASS	AISC- H1-3	0.036	3
		3.46 C	0.00	-1.01	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

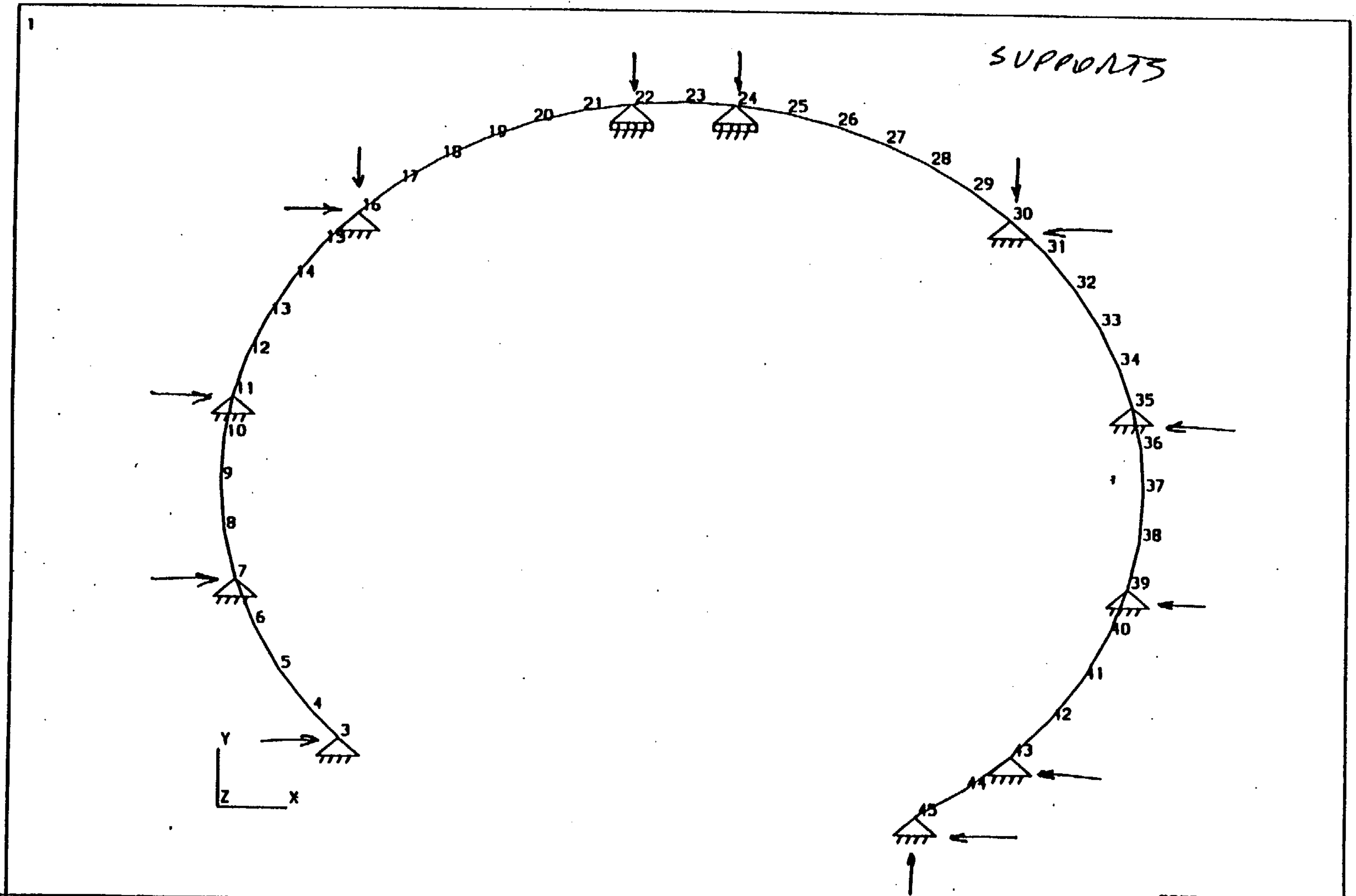
MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.036	3
		3.47 C	0.00	1.01	0.00
28	ST W8X 31	PASS	AISC- H1-3	0.035	3
		3.49 C	0.00	0.90	0.00
29	ST W8X 1	PASS	AISC- H1-3	0.029	3
		3.56 C	0.00	0.56	1.37
30	ST W8X 31	PASS	AISC- H2-1	0.016	3
		0.68 T	0.00	0.71	1.36
31	ST W8X 31	PASS	AISC- H2-1	0.017	3
		0.68 T	0.00	-0.71	0.00
32	ST W8X 31	PASS	AISC- H2-1	0.015	3
		0.59 T	0.00	-0.66	0.00
33	ST W8X 31	PASS	AISC- H2-1	0.010	3
		0.47 T	0.00	-0.44	0.00
34	ST W8X 31	PASS	SHEAR -Y	0.011	3
		0.24 T	0.00	-0.37	1.36
35	ST W8X 31	PASS	AISC- H2-1	0.007	3
		0.12 T	0.00	0.37	0.00
36	ST W8X 31	PASS	AISC- H2-1	0.004	3
		0.02 T	0.00	0.23	0.00
37	ST W8X 31	PASS	SHEAR -Y	0.003	3
		0.19 C	0.00	-0.03	1.56
38	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.29 C	0.00	-0.24	1.57
39	ST W8X 31	PASS	SHEAR -Y	0.007	3
		0.41 C	0.00	0.24	0.00
40	ST W8X 31	PASS	AISC- H1-3	0.007	3
		0.65 C	0.00	0.21	1.57
41	ST W8X 31	PASS	AISC- H1-3	0.007	3
		0.65 C	0.00	-0.21	0.00
42	ST W8X 31	PASS	AISC- H1-3	0.008	3
		0.82 C	0.00	-0.22	1.57
43	ST W8X 31	PASS	AISC- H1-3	0.012	3
		1.48 C	0.00	0.22	0.00
44	ST W8X 31	PASS	AISC- H1-3	0.010	3
		1.57 C	0.00	-0.12	0.00

************** END OF TABULATED RESULT OF DESIGN **************

49. PLOT DISPLACEMENT FILE
50. PLOT BENDING FILE
51. FINISH

*************** END OF STAAD-III ***************

DATE= JUL 18,1995 TIME= 8:27: 0 ******



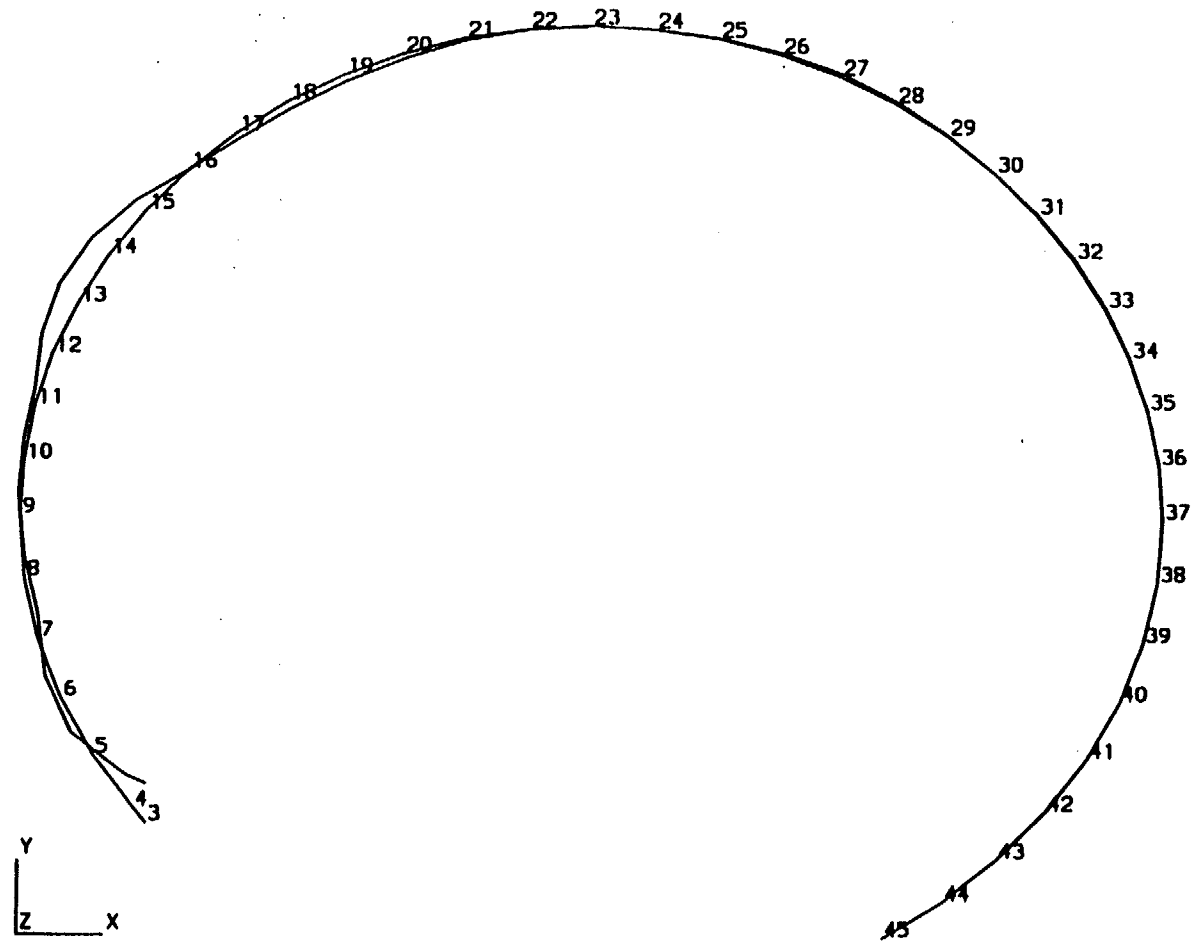
STAADPL-PLOT (REVISION 16.0) STRV 4A

COMPANY: M&O
DATE: APR 24, 1995

TITLE: STAAD PLANE
STRUCTURE DATA N.J= 43, NM= 42, NE= 0

1

DFDR LOAD= 3



FEET KIP

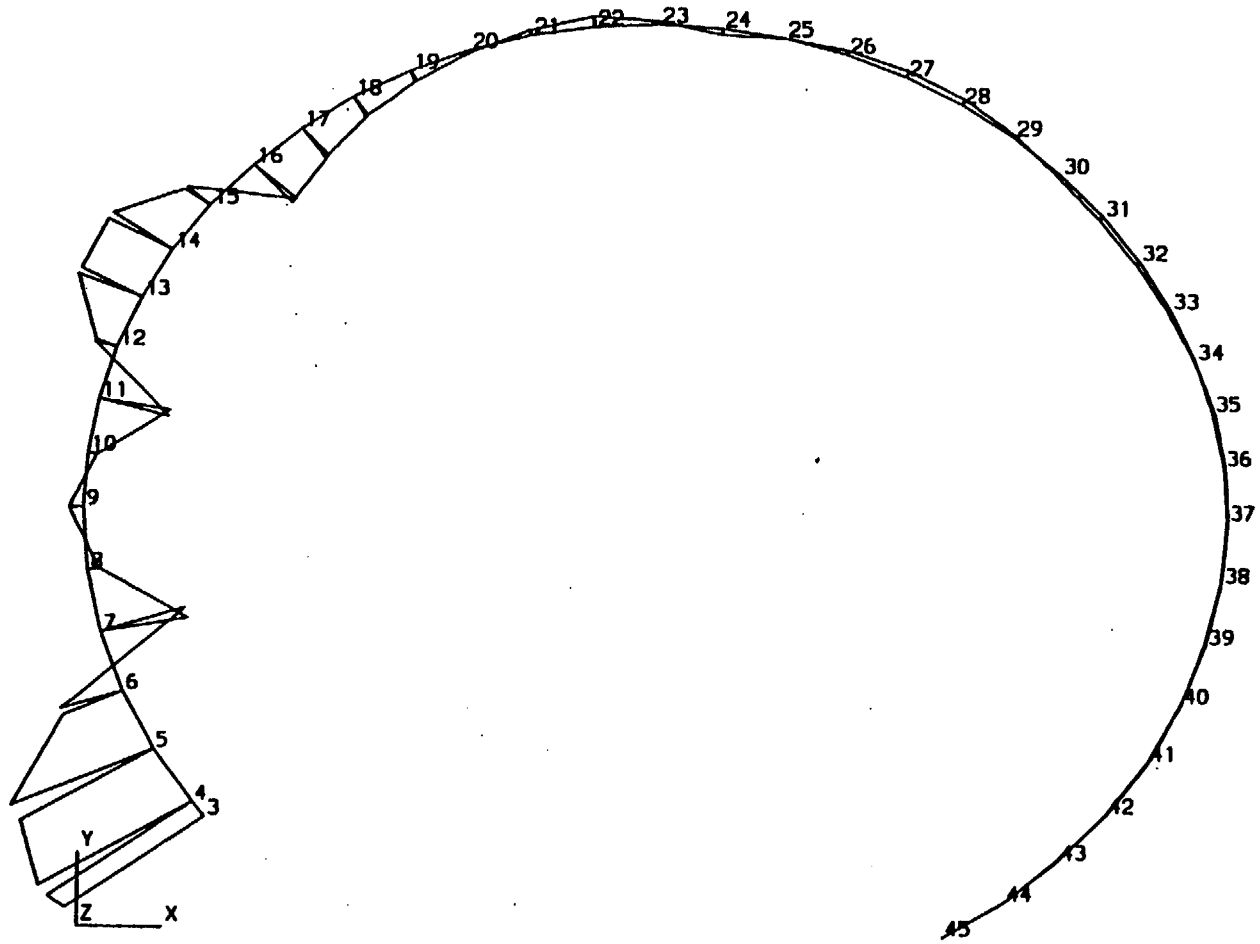
S T A A D P L - P L O T (REVISION 16.0) STRW 4B

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

1

MOMENT MZ LN= 3



FEET KIP

STAADPL - PLOT (REVISION 16.0) STRV 4B

COMPANY: M&O
DATE: JUL 18, 1995

TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

```
****************************************************
*                                                  *
*              S T A A D - III                     *
*              Revision 16.0b                      *
*              Proprietary Program of              *
*              RESEARCH ENGINEERS, Inc.            *
*              Date=     JUL 18, 1995              *
*              Time=     11:28:30                  *
*                                                  *
****************************************************

 1. STAAD PLANE  BABEE0000-01717-0200-00003  ATTACHMENT  I
 2. * ESF GROUND SUPPORT-STRUCTURAL STEEL ANALYSIS REV 00
 3. *
 4. * FILE STLRV4C
 5. * 25 TON JACK APPLIED ONE SIDE @ 47 DEGREES
 6. * MOMENT MZ RELEASED AT THE END OF MEMBERS 15 & 29
 7. * MOMENT MZ RELEASED AT THE START OF MEMBERS 16 & 30
 8. UNIT FT KIP
 9. JOINT COORDINATES
10. 3 3.27 2.13 ; 4 2.43 3.13
11. 5 1.58 4.44 ; 6 0.90 5.85 ; 7 0.40 7.33 ; 8 0.10 8.87
12. 9 0.0 10.43 ; 10 0.08 11.79 ; 11 0.31 13.14 ; 12 0.68 14.45
13. 13 1.21 15.71 ; 14 1.86 16.90 ; 15 2.65 18.02 ; 16 3.56 19.03
14. 17 4.58 19.94 ; 18 5.69 20.73 ; 19 6.89 21.39 ; 20 8.15 21.91
15. 21 9.46 22.29 ; 22 10.80 22.52 ; 23 12.17 22.60 ; 24 13.53 22.52
16. 25 14.87 22.29 ; 26 16.18 21.91 ; 27 17.45 21.39 ; 28 18.64 20.73
17. 29 19.75 19.94 ; 30 20.77 19.03 ; 31 21.68 18.02 ; 32 22.47 16.90
18. 33 23.13 15.71 ; 34 23.65 14.45 ; 35 24.03 13.14 ; 36 24.26 11.79
19. 37 24.33 10.43 ; 38 24.23 8.87 ; 39 23.93 7.33 ; 40 23.44 5.85
20. 41 22.76 4.44 ; 42 21.90 3.13 ; 43 20.88 1.94 ; 44 19.72 0.89
21. 45 18.43 0.00
22. MEMBER INCIDENCE
23. 3 3 4 44
24. UNIT KIP INCH
25. MEMBER RELEASE
26. 15 29 END MZ
27. 16 30 START MZ
28. MEMBER PROPERTIES
29. 3 TO 44 TA STA W8X31
30. CONSTANTS
31. E 29000.0 ALL
32. DENSITY 0.00028 ALL
33. BETA 0 ALL
34. UNIT FT
35. SUPPORT
36. 3 7 11 35 39 43 FIXED BUT FY MZ
37. 22 24 FIXED BUT FX MZ
38. 16 30 45 PINNED
39. UNIT KIP
40. LOAD 1
41. SELF WEIGHT Y -1.0
42. LOADING 2
43. * 25 TON JACK & ONE SIDED JACKING
44. JOINT LOADING
45. 3 FX -34.1
46. 3 FY 36.57
47. 3 MZ 25.00
```

```
48. LOADING COMBINATION 3
49. 1 2.5 2 1.0
50. PERFORM ANALYSIS


      P R O B L E M   S T A T I S T I C S
      -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     43/    42/    11
   ORIGINAL/FINAL BAND-WIDTH =       1/     1
   TOTAL PRIMARY LOAD CASES  =       2, TOTAL DEGREES OF FREEDOM =    115
   SIZE OF STIFFNESS MATRIX =        690 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =       0.08 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                    11:28:33
++ PROCESSING GLOBAL STIFFNESS MATRIX.                     11:28:34
++ PROCESSING TRIANGULAR FACTORIZATION.                    11:28:34
++ CALCULATING JOINT DISPLACEMENTS.                        11:28:35
++ CALCULATING MEMBER  FORCES.                             11:28:35

 51. LOAD LIST 3
 52. PRINT ANALYSIS RESULTS
```

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
3	3	0.00000	0.06910	0.00000	0.00000	0.00000	0.00342
4	3	-0.03097	0.03955	0.00000	0.00000	0.00000	0.00186
5	3	-0.04236	0.02831	0.00000	0.00000	0.00000	0.00008
6	3	-0.02702	0.03218	0.00000	0.00000	0.00000	-0.00100
7	3	0.00000	0.03808	0.00000	0.00000	0.00000	-0.00077
8	3	0.00352	0.03621	0.00000	0.00000	0.00000	-0.00011
9	3	0.00263	0.03360	0.00000	0.00000	0.00000	0.00003
10	3	0.00239	0.03141	0.00000	0.00000	0.00000	0.00013
11	3	0.00000	0.02960	0.00000	0.00000	0.00000	0.00056
12	3	-0.01765	0.03201	0.00000	0.00000	0.00000	0.00079
13	3	-0.03021	0.03454	0.00000	0.00000	0.00000	0.00030
14	3	-0.03095	0.03205	0.00000	0.00000	0.00000	-0.00050
15	3	-0.01909	0.02056	0.00000	0.00000	0.00000	-0.00127
16	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	3	0.00016	-0.00024	0.00000	0.00000	0.00000	-0.00001
18	3	0.00024	-0.00042	0.00000	0.00000	0.00000	-0.00001
19	3	0.00025	-0.00050	0.00000	0.00000	0.00000	0.00000
20	3	0.00019	-0.00043	0.00000	0.00000	0.00000	0.00001
21	3	0.00010	-0.00023	0.00000	0.00000	0.00000	0.00001
22	3	0.00003	0.00000	0.00000	0.00000	0.00000	0.00001
23	3	0.00000	0.00005	0.00000	0.00000	0.00000	0.00000
24	3	-0.00003	0.00000	0.00000	0.00000	0.00000	-0.00001
25	3	-0.00010	-0.00023	0.00000	0.00000	0.00000	-0.00001
26	3	-0.00019	-0.00043	0.00000	0.00000	0.00000	-0.00001
27	3	-0.00025	-0.00050	0.00000	0.00000	0.00000	0.00000
28	3	-0.00024	-0.00042	0.00000	0.00000	0.00000	0.00001
29	3	-0.00016	-0.00024	0.00000	0.00000	0.00000	0.00001
30	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
31	3	-0.00055	-0.00056	0.00000	0.00000	0.00000	-0.00003
32	3	-0.00087	-0.00085	0.00000	0.00000	0.00000	-0.00001
33	3	-0.00084	-0.00087	0.00000	0.00000	0.00000	0.00001
34	3	-0.00048	-0.00076	0.00000	0.00000	0.00000	0.00002
35	3	0.00000	-0.00065	0.00000	0.00000	0.00000	0.00002
36	3	0.00012	-0.00064	0.00000	0.00000	0.00000	0.00000
37	3	0.00010	-0.00065	0.00000	0.00000	0.00000	0.00000
38	3	0.00002	-0.00065	0.00000	0.00000	0.00000	0.00000
39	3	0.00000	-0.00063	0.00000	0.00000	0.00000	0.00001
40	3	0.00025	-0.00069	0.00000	0.00000	0.00000	0.00001
41	3	0.00037	-0.00072	0.00000	0.00000	0.00000	0.00000
42	3	0.00024	-0.00059	0.00000	0.00000	0.00000	-0.00001
43	3	0.00000	-0.00033	0.00000	0.00000	0.00000	-0.00001
44	3	0.00006	-0.00025	0.00000	0.00000	0.00000	-0.00001
45	3	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00001

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
3	3	6.37	0.00	0.00	0.00	0.00	0.00
7	3	27.80	0.00	0.00	0.00	0.00	0.00
11	3	21.31	0.00	0.00	0.00	0.00	0.00
35	3	0.43	0.00	0.00	0.00	0.00	0.00
39	3	-0.31	0.00	0.00	0.00	0.00	0.00
43	3	-0.84	0.00	0.00	0.00	0.00	0.00
22	3	0.00	0.20	0.00	0.00	0.00	0.00
24	3	0.00	0.20	0.00	0.00	0.00	0.00
16	3	-20.92	-34.61	0.00	0.00	0.00	0.00
30	3	-0.83	1.33	0.00	0.00	0.00	0.00
45	3	1.08	0.89	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
3	3	3	45.84	2.29	0.00	0.00	0.00	-25.00
		4	-45.76	-2.22	0.00	0.00	0.00	27.95
4	3	4	45.69	-3.41	0.00	0.00	0.00	-27.95
		5	-45.59	3.48	0.00	0.00	0.00	22.57
5	3	5	44.79	-9.19	0.00	0.00	0.00	-22.57
		6	-44.68	9.24	0.00	0.00	0.00	8.15
6	3	6	43.20	-14.67	0.00	0.00	0.00	-8.15
		7	-43.09	14.71	0.00	0.00	0.00	-14.80
7	3	7	35.43	6.98	0.00	0.00	0.00	14.80
		8	-35.31	-6.95	0.00	0.00	0.00	-3.88
8	3	8	35.91	2.37	0.00	0.00	0.00	3.88
		9	-35.79	-2.37	0.00	0.00	0.00	-0.17
9	3	9	35.81	2.03	0.00	0.00	0.00	-0.17
		10	-35.71	-2.03	0.00	0.00	0.00	2.94
10	3	10	35.27	5.94	0.00	0.00	0.00	-2.94
		11	-35.17	-5.92	0.00	0.00	0.00	11.05
11	3	11	40.13	-10.89	0.00	0.00	0.00	-11.05
		12	-40.03	10.92	0.00	0.00	0.00	-3.79
12	3	12	41.07	-5.93	0.00	0.00	0.00	3.79
		13	-40.97	5.97	0.00	0.00	0.00	-11.92
13	3	13	41.36	-1.77	0.00	0.00	0.00	11.92
		14	-41.27	1.82	0.00	0.00	0.00	-14.35
14	3	14	41.21	2.90	0.00	0.00	0.00	14.35
		15	-41.13	-2.84	0.00	0.00	0.00	-10.42
15	3	15	40.50	7.70	0.00	0.00	0.00	10.42
		16	-40.42	-7.63	0.00	0.00	0.00	0.00
16	3	16	0.70	0.09	0.00	0.00	0.00	0.00
		17	-0.63	-0.01	0.00	0.00	0.00	0.07
17	3	17	0.62	0.03	0.00	0.00	0.00	-0.07
		18	-0.56	0.01	0.00	0.00	0.00	0.12
18	3	18	0.56	0.06	0.00	0.00	0.00	-0.12
		19	-0.51	0.03	0.00	0.00	0.00	0.13

MEMBER END FORCES   STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
19	3	19	0.51	0.02	0.00	0.00	0.00	-0.13
		20	-0.47	0.07	0.00	0.00	0.00	0.10
20	3	20	0.48	-0.02	0.00	0.00	0.00	-0.10
		21	-0.45	0.12	0.00	0.00	0.00	0.00
21	3	21	0.46	-0.07	0.00	0.00	0.00	0.00
		22	-0.44	0.17	0.00	0.00	0.00	-0.16
22	3	22	0.47	0.08	0.00	0.00	0.00	0.16
		23	-0.46	0.03	0.00	0.00	0.00	-0.13
23	3	23	0.46	0.03	0.00	0.00	0.00	0.13
		24	-0.47	0.08	0.00	0.00	0.00	-0.16
24	3	24	0.44	0.17	0.00	0.00	0.00	0.16
		25	-0.46	-0.07	0.00	0.00	0.00	0.00
25	3	25	0.45	0.12	0.00	0.00	0.00	0.00
		26	-0.48	-0.02	0.00	0.00	0.00	0.10
26	3	26	0.47	0.07	0.00	0.00	0.00	-0.10
		27	-0.51	0.03	0.00	0.00	0.00	0.13
27	3	27	0.51	0.03	0.00	0.00	0.00	-0.13
		28	-0.56	0.06	0.00	0.00	0.00	0.12
28	3	28	0.56	0.01	0.00	0.00	0.00	-0.12
		29	-0.62	0.08	0.00	0.00	0.00	0.07
29	3	29	0.63	-0.01	0.00	0.00	0.00	-0.07
		30	-0.70	0.09	0.00	0.00	0.00	0.00
30	3	30	-0.84	0.26	0.00	0.00	0.00	0.00
		31	0.76	-0.19	0.00	0.00	0.00	0.31
31	3	31	-0.78	0.10	0.00	0.00	0.00	-0.31
		32	0.69	-0.04	0.00	0.00	0.00	0.40
32	3	32	-0.69	-0.04	0.00	0.00	0.00	-0.40
		33	0.60	0.09	0.00	0.00	0.00	0.32
33	3	33	-0.59	-0.16	0.00	0.00	0.00	-0.32
		34	0.49	0.20	0.00	0.00	0.00	0.08
34	3	34	-0.47	-0.25	0.00	0.00	0.00	-0.08
		35	0.37	0.28	0.00	0.00	0.00	-0.28
35	3	35	-0.26	0.11	0.00	0.00	0.00	0.28
		36	0.16	-0.09	0.00	0.00	0.00	-0.14

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
36	3	36	-0.17	0.07	0.00	0.00	0.00	0.14
		37	0.06	-0.06	0.00	0.00	0.00	-0.05
37	3	37	-0.07	-0.06	0.00	0.00	0.00	-0.05
		38	-0.05	0.06	0.00	0.00	0.00	-0.04
38	3	38	0.04	-0.07	0.00	0.00	0.00	0.04
		39	-0.16	0.09	0.00	0.00	0.00	-0.17
39	3	39	0.24	0.18	0.00	0.00	0.00	0.17
		40	-0.36	-0.14	0.00	0.00	0.00	0.08
40	3	40	0.37	0.10	0.00	0.00	0.00	-0.08
		41	-0.48	-0.04	0.00	0.00	0.00	0.19
41	3	41	0.48	-0.02	0.00	0.00	0.00	-0.19
		42	-0.58	0.09	0.00	0.00	0.00	0.11
42	3	42	0.57	-0.16	0.00	0.00	0.00	-0.11
		43	-0.66	0.24	0.00	0.00	0.00	-0.20
43	3	43	1.24	0.24	0.00	0.00	0.00	0.20
		44	-1.32	-0.15	0.00	0.00	0.00	0.11
44	3	44	1.33	-0.02	0.00	0.00	0.00	-0.11
		45	-1.40	0.12	0.00	0.00	0.00	0.00

************** END OF LATEST ANALYSIS RESULT **************

53. CHECK CODE ALL

STAAD-III CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST W8X 31	PASS	AISC- H1-2	0.745	3
		45.76 C	0.00	27.95	1.31
4	ST W8X 31	PASS	AISC- H1-2	0.745	3
		45.69 C	0.00	-27.95	0.00
5	ST W8X 31	PASS	AISC- H1-2	0.642	3
		44.79 C	0.00	-22.57	0.00
6	ST W8X 31	PASS	AISC- H1-2	0.490	3
		43.09 C	0.00	-14.80	1.56
7	ST W8X 31	PASS	AISC- H1-2	0.452	3
		35.43 C	0.00	14.80	0.00
8	ST W8X 31	PASS	AISC- H1-2	0.253	3
		35.91 C	0.00	3.88	0.00
9	ST W8X 31	PASS	AISC- H1-2	0.235	3
		35.71 C	0.00	2.94	1.36
10	ST W8X 31	PASS	AISC- H1-2	0.381	3
		35.17 C	0.00	11.05	1.37
11	ST W8X 31	PASS	AISC- H1-2	0.407	3
		40.13 C	0.00	-11.05	0.00
12	ST W8X 31	PASS	AISC- H1-2	0.427	3
		40.97 C	0.00	-11.92	1.37
13	ST W8X 31	PASS	AISC- H1-2	0.473	3
		41.27 C	0.00	-14.35	1.36
14	ST W8X 31	PASS	AISC- H1-2	0.473	3
		41.21 C	0.00	14.35	0.00
15	ST W8X 31	PASS	AISC- H1-2	0.397	3
		40.50 C	0.00	10.42	0.00
16	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.63 C	0.00	0.07	1.37
17	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	0.12	1.36
18	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	-0.12	0.00
19	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	-0.13	0.00
20	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.48 C	0.00	-0.10	0.00
21	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.44 C	0.00	-0.16	1.36
22	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.47 C	0.00	0.16	0.00
23	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.47 C	0.00	-0.16	1.36
24	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.44 C	0.00	0.16	0.00
25	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.48 C	0.00	0.10	1.36
26	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	0.13	1.37

L UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

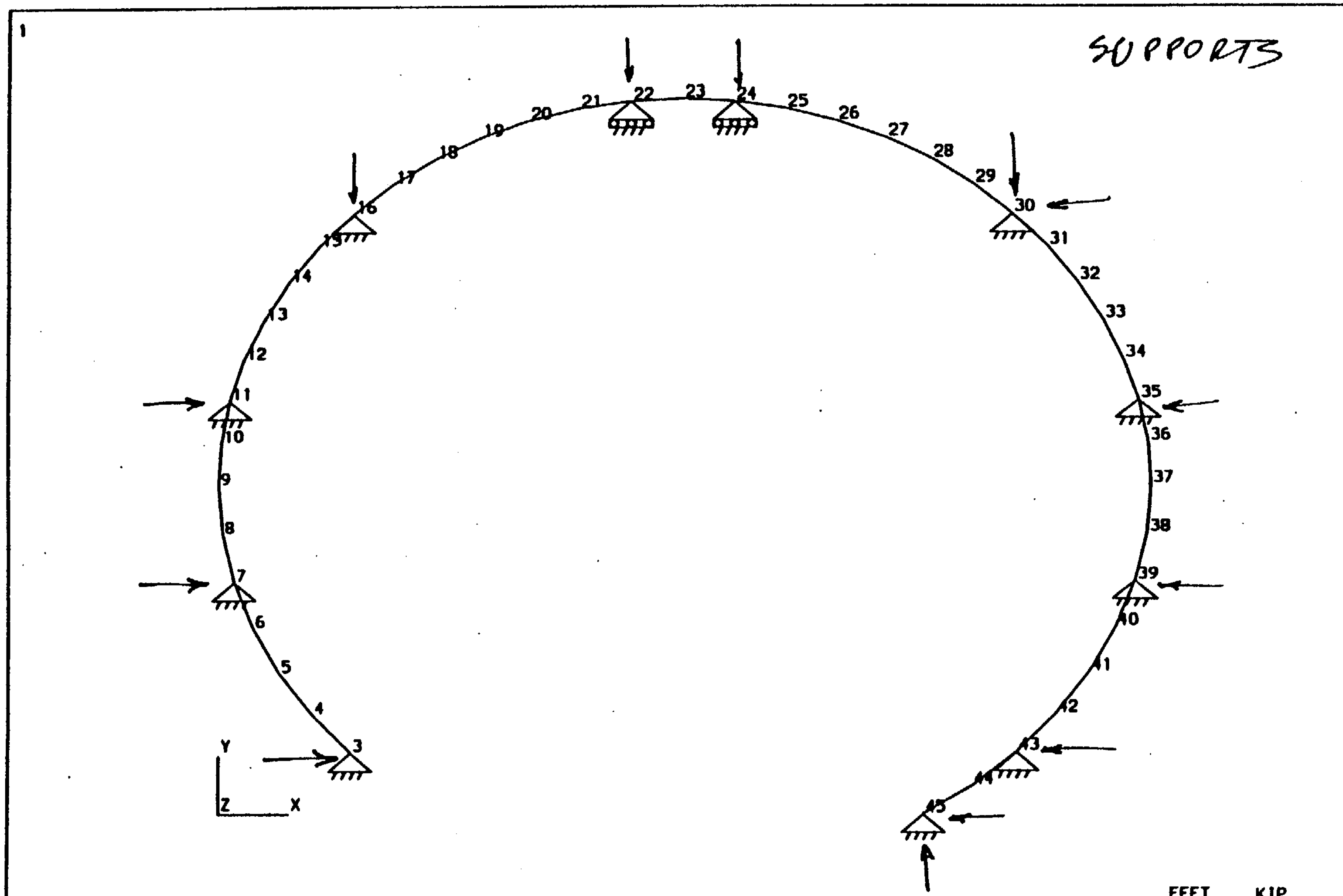
MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.51 C	0.00	-0.13	0.00
28	ST W8X 31	PASS	AISC- H1-3	0.005	3
		0.56 C	0.00	-0.12	0.00
29	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.63 C	0.00	-0.07	0.00
30	ST W8X 31	PASS	AISC- H2-1	0.010	3
		0.76 T	0.00	0.31	1.36
31	ST W8X 31	PASS	AISC- H2-1	0.011	3
		0.69 T	0.00	0.40	1.37
32	ST W8X 31	PASS	AISC- H2-1	0.011	3
		0.69 T	0.00	-0.40	0.00
33	ST W8X 31	PASS	AISC- H2-1	0.009	3
		0.59 T	0.00	-0.32	0.00
34	ST W8X 31	PASS	SHEAR -Y	0.008	3
		0.37 T	0.00	-0.28	1.36
35	ST W8X 31	PASS	AISC- H2-1	0.006	3
		0.26 T	0.00	0.28	0.00
36	ST W8X 31	PASS	AISC- H2-1	0.003	3
		0.17 T	0.00	0.14	0.00
37	ST W8X 31	PASS	SHEAR -Y	0.002	3
		0.05 C	0.00	-0.04	1.56
38	ST W8X 31	PASS	AISC- H1-3	0.004	3
		0.16 C	0.00	-0.17	1.57
39	ST W8X 31	PASS	SHEAR -Y	0.006	3
		0.24 C	0.00	0.17	0.00
40	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.48 C	0.00	0.19	1.57
41	ST W8X 31	PASS	AISC- H1-3	0.006	3
		0.48 C	0.00	-0.19	0.00
42	ST W8X 31	PASS	SHEAR -Y	0.007	3
		0.66 C	0.00	-0.20	1.57
43	ST W8X 31	PASS	AISC- H1-3	0.010	3
		1.24 C	0.00	0.20	0.00
44	ST W8X 31	PASS	AISC- H1-3	0.009	3
		1.33 C	0.00	-0.11	0.00

************** END OF TABULATED RESULT OF DESIGN **************

54. PLOT DISPLACEMENT FILE
55. PLOT BENDING FILE
56. FINISH

*************** END OF STAAD-III ***************

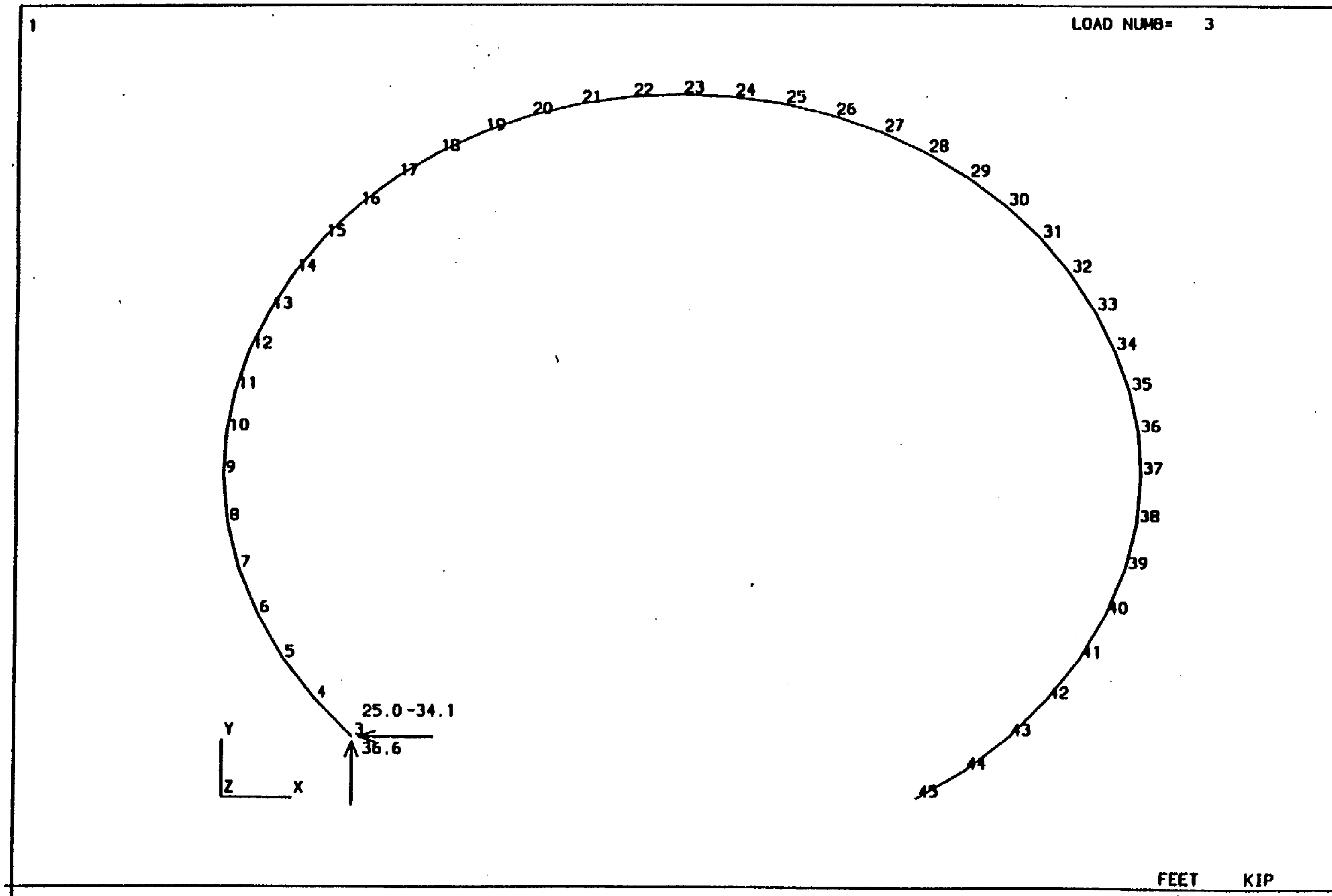
DATE= JUL 18,1995 TIME= 11:28:39 ******



STAADPL-PLOT (REVISION 16.0) STZRV4C

COMPANY: M&O
DATE: APR 24, 1995

TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0



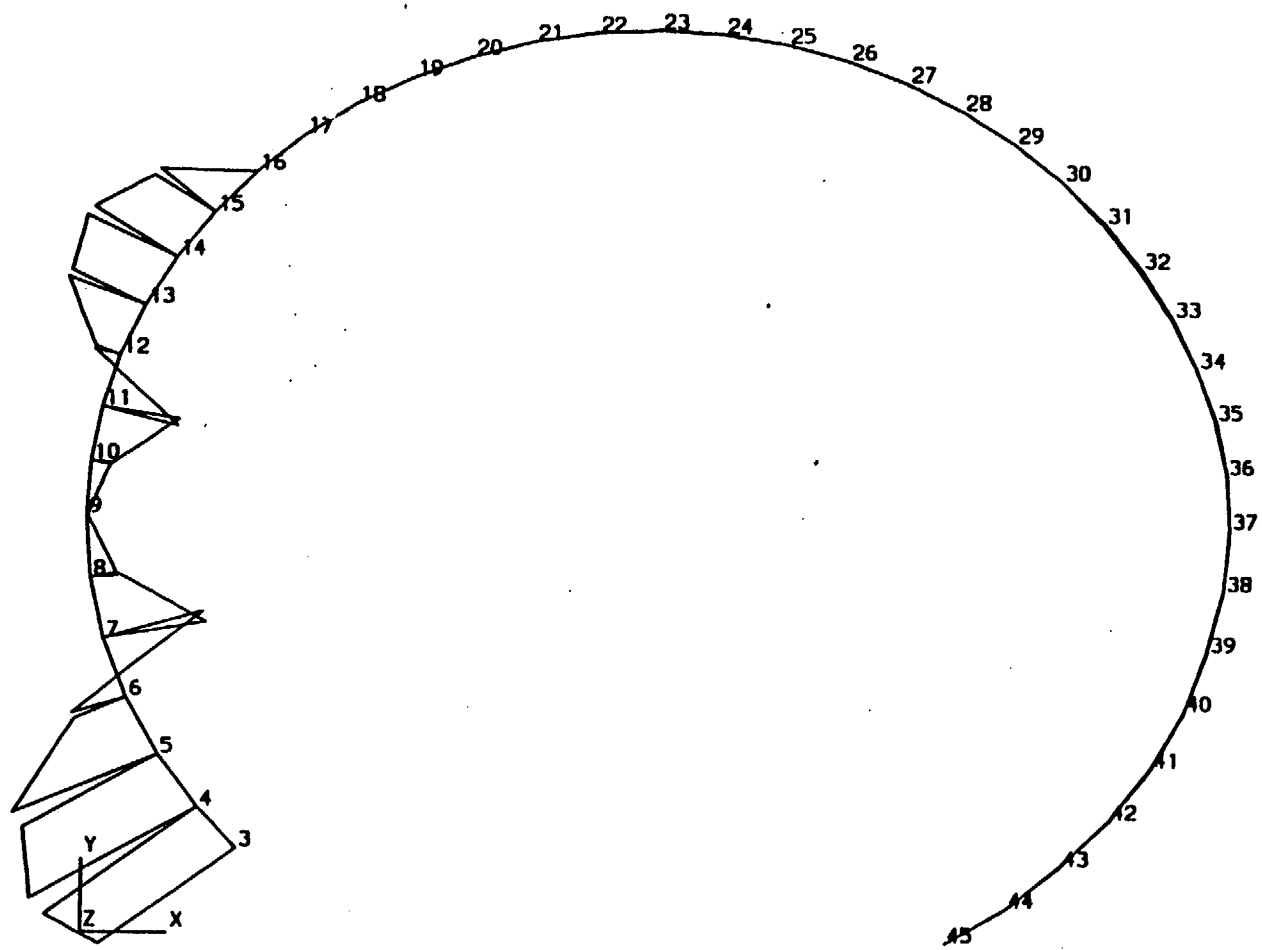
STAADPL-PLOT (REVISION 16.0) STRV 4C

COMPANY: M&O
DATE: APR 24, 1995

TITLE: STAAD PLANE
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

1

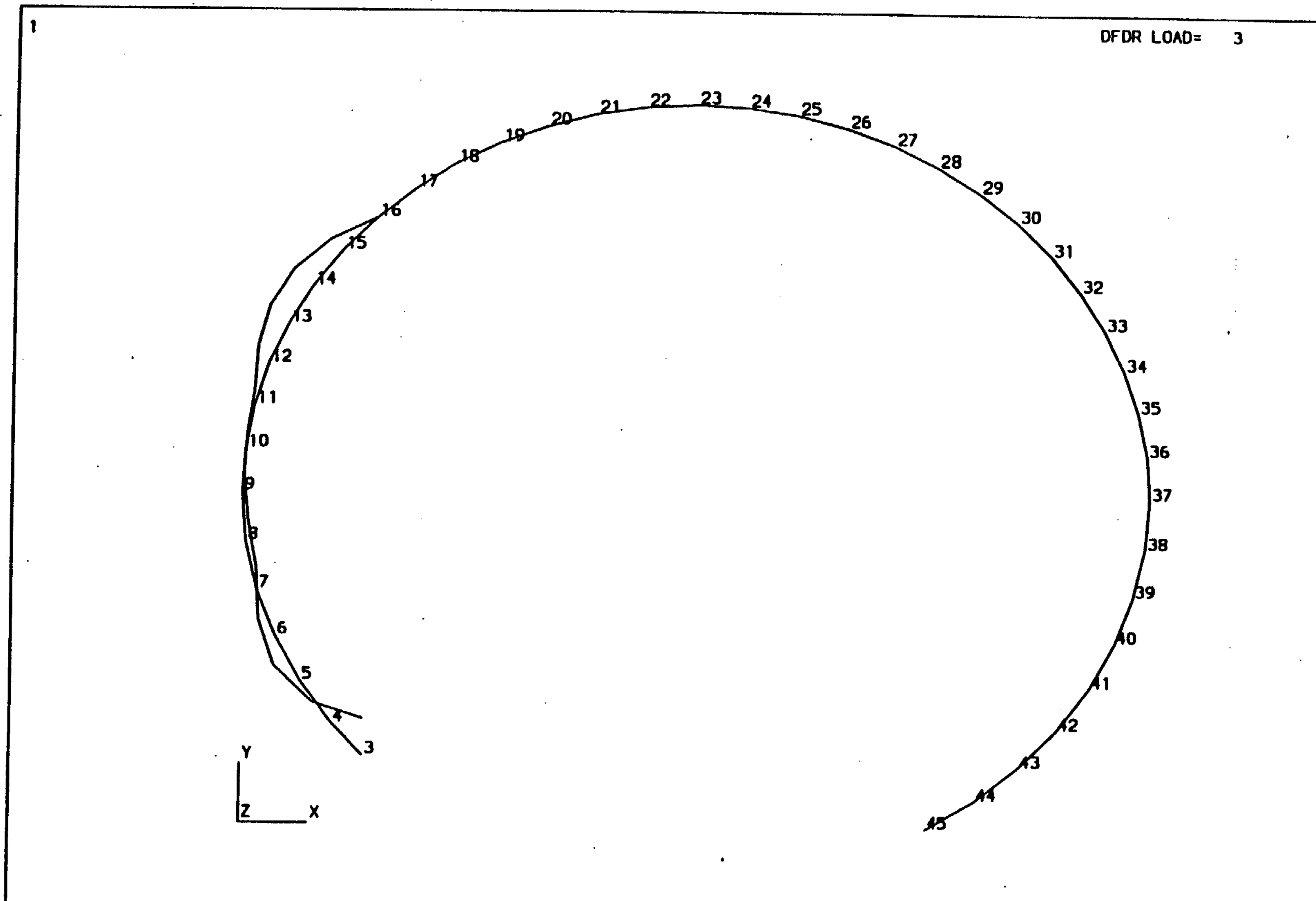
MOMENT MZ LN= 3



FEET KIP

COMPANY: M&O
DATE: JUL 18, 1995

S T A A D P L - P L O T (REVISION 16.0) STZ RV 4C
TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 43, NM= 42, NE= 0



FEET KIP

COMPANY: M&O
DATE: JUL 18, 1995

S T A A D P L - P L O T (REVISION 16.0) STZ RV 4C
TITLE: BABEE0000-01717-0200-00003 ATTACHMENT
STRUCTURE DATA NJ= 43, NM= 42, NE= 0

SUMMARY OF COMPUTER ANALYSES FOR JACKING LOADS

Analysis No.	LOAD	SCOPE	Supports	Interaction coefficient	Member	Comparison Conclusion
1. STLRV2	50T @ 47 30T @ 47 25T @ 47 Both sides	Determine jack capacity to be used	@ every 4th node	50T: 1.488 30T: 0.893 25T: 0.744	3 3 3, 4, 42	Steel set not adequate Too close Steel set adequate
2. STLRV3A	25T @ 49 Both sides	)Check W8X31 size of)steel set)Compare results of	@ every 4th node	0.730	3	Size of steel set W8X31 is adequate 47 degree governs
3. STLRV3D	25T @ 51 Both sides	)varying the angle of)application of the jack	@ every 4th node	0.717	3,4,41,42	by a very small margin.
4. STLRV3B	25T @ 47 Both sides	)) Same as above)with moment released	@ every 4th node	0.745	3,4,41,42	Moment release at splice can be accommodated by
5. STLRV3C	25T @ 49 Both sides	)at splice)	@ every 4th node	0.731	3	the steel set W8X31
6. STLRV3A1	25T @ 47 Both sides	)) Check stresses for) partial and full	@ most nodes	0.729	3, 42	Full rock engagement governs
7. STLRV3A2	25 T @ 47 Both sides	)rock engagement)	@ all nodes	0.767	3, 42	Size of W8X31 steel set is adequate
8. STLRV4	25T @ 47 on one side	)Evaluate stresses)in the steel set due)to one side jacking	@ every 4th node	0.744	3, 4	Jacking from one side only, can be
9. STLRV4A	25T @ 49 on one side	)for the applicable)angles of application)of the jacking load	@ every 4th node	0.730	3,4	accommodated by the steel sets. 47 deg. governs by a small margin.

10. STLRV4B	25T @ 51 on one side	) See above on)previous page	@ every 4th node	0.717	3, 4	
11. STLRV4C	25T @ 47 on one side	)Check stresses in the)steel set with the)moment released)at splice.	@ every 4th node	0.745	3, 4	Moment release at splice can be accommodated by the steel sets

JACKING PROCESS CONCLUSIONS

A W8X31 shape is selected as a trial member for the steel set ring member, to be verified in Attachment III, provided that the Contractor uses the following controls in the jacking procedure:

- The jacking force shall not exceed 27 tons per jack. (See File STLRV2 and Attachment III page III-27)

- The jack centerline position shall be no more than 6 inch from the X-X axis of the W8X31.
(see pages I-7 and I - 23).

- Jacking forces may be applied on both sides or one one side only of the steel set, since stresses are the same in either condition. (See Summary of Computer Analyses for Jacking Loads).